

Secretary's Note: It is the intention of the Correlating Committee that where cross references are made to the 0 to 2,000 volt conductor ampacity tables covered in Section 310-15(a) that generic references to the tables will be made.

ARTICLE 90 -- INTRODUCTION

Log # 1231

1- 1 - (Article 90): Reject

SUBMITTER: Gersil N. Kay, M. Newmark & Bro. Inc.

RECOMMENDATION: Add:

SPECIAL HISTORIC BUILDINGS AND DISTRICTS

"Approval: The provisions of this Code relating to the construction, repair, alteration, enlargement, restoration and moving of buildings or structures shall not be mandatory for existing buildings or structures identified and classified by the local, state or federal government authority as historic buildings, subject to the approval of the board of appeals, when such buildings are judged by the code official to be safe and in the interest of public health, safety and welfare regarding any proposed construction, alteration, repair, enlargement and relocation. All such approvals shall be based on the applicant's complete submission of professional architectural and engineering plans and specifications bearing the professional seal of the designer."

SUBSTANTIATION: In 1986, there was \$87 BILLION in Restoration/Renovation in this country. In fact, this type of construction has been leading new construction for three years. Allowing flexibility to the inspectors to grant variances while keeping the intent of life safety, would save expensive time in negotiating each case individually and also save our priceless architectural heritage. The economic well-being of the United States would also be insured by the expansion of the market for Rehabilitation.

Precedent for this paragraph exists in 1981 and 1987 BOCA Code, Section 513.0 SPECIAL HISTORIC BUILDINGS AND DISTRICTS and 531.1 Approval.

The only Investment Tax Credit kept by the US Congress was for Historic Restoration. For every \$1 the government up in taxes, it gains \$5 in Revenue from buildings and people being put back on the tax rolls. Entire neighborhoods are rejuvenated; improving quality of life for all.

PANEL ACTION: Reject.

PANEL COMMENT: This statement may be suitable as an administrative guideline for local enforcement, but is unsuitable for mandatory across-the-board application in the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2650

1- 2 - (90-1(c), FPN-(New)): Reject

Secretary's Note: The Correlating Committee recommends that CMP 1 review the Standards Council policy on health related hazards as it relates to this proposal.

SUBMITTER: Patricia B. Horton, Allied Tube & Conduit Corporation

RECOMMENDATION: Add a FPN to read:

FPN: Because this Code is not a design manual, fire hazards from necessarily combustible electrical products can be addressed only on a general basis.

While the recognized uses are considered to provide a basically acceptable level of fire risk, users of materials recognized by this Code are cautioned to assess the many variables involved in the use of combustible materials in their design considerations. These could include, but are not necessarily limited to: flame spread; rate of heat release; visible smoke emission; ignitability; toxic gas emission; building occupancy, i.e., mental/physical condition, age, restraint, density; construction characteristics, ease of egress, sprinklers, smoke-detectors, assurance that Code compliance is maintained; and the effects of corrosive fire vapors on equipment.

Research is in progress to standardize risk assessment methods.

SUBSTANTIATION: Because (1) risk assessment methods are incomplete and will likely take several more years to achieve the necessary level of sophistication required for all types of buildings, and (2) the NEC is not a design manual and does not divide its

requirements by occupancy and construction type to the extent contained in either NFPA 101-Life Safety Code or the building Codes it is obvious that the many variables listed above have not been considered for the multiplicity of designs available.

Designers and users of products avail themselves of the NEC the same as inspectors. They should not be lulled into thinking the NEC has completed all these assessments for them. This, or similar language, should meet any NFPA duty to warn until such time that more complete risk/hazard assessment is available to allow a review of ALL building types and occupancies.

The Toxicity Advisory Committee has said, for example, with hotels, shopping malls, schools, etc., they see no need for a total restriction on non-metallic tubing. I can't imagine they could assess to such a degree as to see NO installation of this type where the risk would be greater than in others. The NEC is just not geared at this time to make these detailed assessments, nor has a consistency in Code requirements relative to combustibles been achieved. That's not a criticism, just a fact that only time can correct.

PANEL ACTION: Reject.

PANEL COMMENT: The FPN is contradictory to Section 90-1(c) that the Code is not intended as a design specification.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

BORLEIS: While I agree with the Panel Action to reject this proposal, I do not agree with the Panel Comment. The proposer states in the proposed FPN that the Code is not a design manual. I believe the proposal should be rejected on the basis that the NEC is a Code containing rules for the safe use of electricity. It is not a general fire code which concerns itself with all the products and materials in the entire building of which the electrical equipment is a minor part. The proposal has nothing to do with the safe use of electricity.

Log # 2724

1- 3 - (90-2(a)(1), FPN-(New)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to paragraph 90-2(a)(1):

"(FPN): For additional information concerning installations in commercial buildings, see "IEEE Recommended Practice for Electric Power Systems in Commercial Building".

SUBSTANTIATION: The application of sound electrical engineering principles described in the FPN should assist in installations complying with the NEC. Electrical blueprints for commercial buildings often omit considerations for maintainability leading to unsafe practices and the defeat of NEC intentions.

PANEL ACTION: Reject.

PANEL COMMENT: It is not the intent of the Code to reference all documents that may be used in the electrical design of buildings and systems.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2725

1- 4 - (90-2(a)(1), FPN-(New)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to paragraph 90-2(a)(1):

"(FPN): For additional information concerning installations in industrial plants, see "IEEE Recommended Practice for Electric Power Distribution for Industrial Plants, ANSI/IEEE Std 141-1986".

SUBSTANTIATION: The application of sound electrical engineering principles described in the FPN should assist in installations complying with the NEC. Too often electrical blueprints for industrial plants omit considerations for maintainability of electrical systems leading to hazardous operating practices or the defeat of integral safety devices to repair equipment.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-3.

VOTE ON PANEL ACTION: Unanimously Affirmative.

1- 5 - (90-2(b)(2)): Reject

SUBMITTER: Robert L. Simpson, Institute of Electrical and Electronics Engineers, Inc.

RECOMMENDATION: Revised text:

Installations and Equipment under the exclusive control of a mining company which are used only for the purpose of mining, and where the conditions of maintenance and supervision assure that only qualified persons operate and service the equipment and/or installation.

(FPN) It is the intent that the NEC shall be applicable in the case of buildings used by the mines for purposes other than the mining operation, such as office buildings, warehouses, garages, machine shops, dining facilities, visitor centers, recreational buildings, and permanently fixed processing plants.

SUBSTANTIATION: Electrically driven mining machines, and their power support installations, as used today in surface mining, were essentially developed in the time period between 1940 and 1970. During this time period, the manufacturers of mining machines did not attempt to design their machines to comply with the NEC for three reasons.

ONE - There was not demand from users for a change in design, because of the excellent safety record of surface mining machines.

TWO - From 1940 to 1968, all "installations in mines" were specifically exempted in the scope of the National Electric Code.

THREE - There were no provisions written into the NEC that were intended to cover the special conditions that exist on surface mining machines until the 1975 version of the NEC was printed. The special conditions include such items as high and low voltage ac, high and low voltage dc, grounded and ungrounded circuits, specially designed complete drive circuits, the machine frame completely constructed of steel, and with power and grounding both supplied through a special trailing cable from a remote source that may be within one thousand feet of the machine or may be more than a mile distant from the machine.

In 1968, the mining exemption, in the NEC, was changed from "installations in mines" to "installations underground in a mine". This meant that the special UNDERGROUND mining machines developed between 1940 and 1970 were still exempt but that the special machines developed for surface mines in the same time period would no longer be exempt if an authority having jurisdiction decided to adopt the Code for regulatory purposes.

PL 91-173 was promulgated, by congress, as THE FEDERAL COAL MINE HEALTH AND SAFETY ACT in December 1969. In June 1970, CFR30 part 77 became effective as federal law to regulate surface coal mines. Article 516 of CFR-30 Part 77 adopted by reference, the National Electric Code of 1968, or the most recent version, to apply to all parts of a surface mine on any rule not specifically covered elsewhere in of part 77.

Some of the articles and sub sections of the NEC can be applied to mining machines, but many cannot or should not be applied due to either the intent for which the section was written, or just plain non-applicability, (i.e. electric dryers). This did not create a problem in the early years of the regulation, but in the mid 1970s the determination, by MSHA, was made that the NEC, in its entirety, could be applied to the special mining machines. This has resulted in gross misapplications of the NEC. The misapplications, in turn, resulted in increased cost and lost time to the mining industry, without an equivalent increase in safety.

In 1981, the Ad Hoc Subcommittee on mining related subjects, was requested by the Correlating Committee of the National Electric Code, to investigate the applicability of the National Electric Code in its entirety to all parts of a mine not covered by the exemption in the scope to "underground parts of a mine". The Ad Hoc Committee recommended three additional exemptions

ONE - Proposal 1-9 - 90-2(b)(2) - Change to exempt the underground installations in a mine and the equipment and installations located above the surface that are used exclusively in conjunction with the mining operations, and that are under the exclusive control of the mine, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the installation.

TWO - Proposal 1-12 - 90-2(b)(6) - Equipment and installation under the exclusive control of a mining company which are used exclusively for the purpose of surface mining, strip mining, or open pit mining, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment and installation.

THREE - Proposal 1-15 - Installation in mining related tipplers, mills, concentration, beneficiation and preparation plants that are used exclusively in conjunction with a mining operation, that are under the exclusive control of the mine, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment.

The codemaking panel turned down all three proposals, but after objections from many sources, agreed to hold the proposals over for further study in the NEC-TCR-83-A. Most of the reasons listed for rejection appeared to show a misunderstanding of, or lack of knowledge about mining installations. For instance, reference was made to the uncertainty of MSHA adopting the NEC, when in fact MSHA had adopted the Code in its entirety when the rules were promulgated for surface mines in CFR30, part 77 in 1969. Reference was also made to the slow progress of the IEEE working groups in producing guidelines for mining as a reason for rejection. This is completely irrelevant, in that all types of mining have existed thus far in time without IEEE guidelines. The NEC, in its entirety, is not required for MSHA to function, with respect to mining machines. This is evidenced by the fact that only surface coal regulations reference the NEC in its entirety while all other types and kinds of mining use only a few applicable sections of the NEC. Metal and nonmetal surface and underground installations are very adequately administered by MSHA. There are very few or no contentious issues due to interpretation of the references to the National Electric Code in the metal and nonmetal regulations. In contrast, surface coal has had so many and varied problems that industry has spent thousands of dollars in citation costs, many of which were irrelevant to safety, due to misinterpretation of the NEC.

Meetings between the American Mining Congress and Mines Safety and Health Administration personnel have resulted in mutual recognition that the NEC in its entirety cannot be reasonably applied to mining machines used in the pit to remove overburden and/or win coal. Many hours and dollars have been expended by an already economically strapped industry to go through the National Electric Code, sentence by sentence, to decide which parts are applicable to the machines in the pit and which have no application whatsoever.

From the mining industry's perspective, it is desirable that the exemptions from the NEC be returned to the mining industry to prevent other authorities, with jurisdiction, from inadvertently passing laws that could allow the NEC to be misapplied.

This application for modification takes note of the similarity of the existing NEC exemptions in 90-2(b) to the conditions which prevail in mining. Most exemptions apply to mobile type equipment. The electrically powered mining equipment, used in surface mining, requires exemption for the same reasons other mobile equipment has exemptions. The other main reason for exemption appears to be for the communications and power industries on the premise that they limit access to specific problem areas to qualified personnel only. The mining industry not only restricts many areas from the general public, it is compelled by law to only allow access to all areas dedicated to mining to qualified, trained personnel. Furthermore, these qualified people must periodically undergo retraining to maintain their certification.

In addition, all electrical installations must be marked with suitable "danger" signs, transformers stations enclosed by fences, and gates kept locked against unauthorized entry.

It would appear that special guarding of exposed electrical equipment, limiting access to qualified personnel, and requiring special training to qualify electrical personnel, would justify treating the electrically non-standard areas of a mine to the same status as accorded the power and communications industries in their exemptions.

The mining industry's interest could best be served by acceptance of this proposal. The working group of P795 surface mines of IEEE, I.A.S. mine industries is now reviewing for approval guidelines for surface mining electrical. This should be ready for requested acceptance by IEEE for publication as guidelines at an early date. A copy of this guide will be provided if requested.

PANEL ACTION: Reject.

PANEL COMMENT: This proposal and other identical or near identical proposals addresses a subject that Code-Making Panel 1 has been dealing with since the 1978 NEC. At that time IEEE made a proposal to amend the scope of the NEC to cover "Installations in underground coal mines as referred to by the Federal Coal Mine Safety and Health Act."; and to grant an exemption for Underground "metal and non-metallic" mines. This proposal (Section 90-2, Proposal No. 4) was rejected by CMP 1 with the following Panel Comment:

"The Code has been developed without specific consideration to the specialized needs relating to underground mines and the general disclaimer that it does not cover installation underground in mines should stand, at least for the present. Many provisions of the Code should be applicable in such situations and suitable referencing of the NEC provisions by cognizant authorities may be appropriate but should not be constrained by a scope change in the NEC itself."

Subsequent to this action the NEC Correlating Committee, at the request of CMP 23, set up an Ad hoc Sub-committee with the following Scopes:

1. AHSC on Underground Mines. To determine the need for expanding the scope of the NEC relative to underground mines.

2. AHSC on Surface Mining. To prepare proposed requirements for surface mining within the purpose of the NEC. (Section 90-2).

3. AHSC on Mining Related Preparation Plants. To prepare proposed requirements for mining related preparation plants within the requirements of the NEC. (Section 90-2).

The request for the formation of these subcommittees originated in Code-Making Panel 23 of the National Electrical Code Committee. CMP 23 believes that a study of the electrical safety requirements in these areas will result in proposals for standards suitable for NEC inclusion that will diminish confusion now prevalent in the industry. They further believe that the NEC is the proper document for effective voluntary consensus rules that are adopted by regulatory bodies. The Correlating Committee agrees."

The scope has been reproduced verbatim herein because the substantiation for these proposals take liberties in describing the scope and accomplishments of the Ad-hoc Subcommittee. The Ad-hoc subcommittee chose not to follow its scope and in fact chose to recommend further expansion of the NEC exemptions; rather than preparing proposed requirements. The Ad-hoc subcommittee's primary conclusion was to "exclude all mining from the NEC in its present form, then rely on a separately produced document as a replacement. The Ad-hoc Subcommittee chose as the most logical replacement IEEE Standard Projects 791, 793, 794 and 795.

Code-Making Panel #1 reviewed these proposals for the 1984 NEC which were held on the docket for further study, and subsequently a CMP 1 Ad-hoc subcommittee was formed consisting of a member of CMP 1 as Chairman, 2 CMP 1 representatives from the original Ad-hoc Subcommittee on Mining Related Subjects, 2 mining representatives from the original Ad-hoc Subcommittee, and one representative from MSHA. After careful review of all the activities leading to Proposals 1-9, 1-12 and 1-15, and recent activities within IEEE and MSHA, the Subcommittee unanimously recommended rejection of the proposals.

It was noted in so doing that IEEE had reactivated its working groups on P-794-Underground Mines; Metal and Non-Metal Mining P-795 Surface; Metal and Non-Metal P-793-Preparation Plants; Coal P-685-Power Center; and Coal P-791-Underground Gassy Mines.

It should be noted that the supporting comments of the 1990 NEC proposals now state that it is irrelevant whether IEEE ever completes its work on mining recommended practices.

Code-Making Panel No. 1 is rejecting further exemptions for aboveground mining for the following reasons:

1. Underground mining has not been covered by the National Electrical Code requirements since 1937. The change which occurred in 1968 was made to clarify coverage in Section 90-2.

2. As with the adoption of the NEC by any governmental bodies exercising legal jurisdiction it is up to those bodies to determine the degree and extent of retroactive coverage and determination of applicability of the specific rules.

3. There is no evidence that the IEEE recommended practices, if completed, would be acceptable to MSHA as a substitute for the NEC.

4. While these proposals would relieve the mining industry of compliance with electrical safety requirements for certain equipment, exemptions in the 1990 NEC might not result in relief because the 1968 edition of the Code is being used by MSHA.

5. It has been cited that mining operations have special features, differences in application, and special techniques that are different from other industries, but the fact is that Chapters 5, 6, 7 and 8 of the Code cover industries with particular electrical installation needs.

6. Apparently MSHA officials have been working with the mining industry to refine and define the applicability of the NEC Rules which could alleviate compliance difficulties. However, CMP 1 is unaware that MSHA is actively supporting the effort to further expand NEC exemptions for certain aboveground installations.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Palko, Voltz.

EXPLANATION OF VOTE:

PALKO: The crux of the lengthy reason given for rejection contains little more than documentation of previous rejections of a similar proposal that had been submitted for the 1978, 1981, 1984, and 1987 NEC. Analysis of the lengthy panel comment, however, reveals little of substance to support rejection. The discourse on activity or inactivity within the IEEE Mining Industry Committee, the mining industry, per se, and conjecture as to what MSHA might or might not do does not address the proposal. To cite as fact that Chapters 5, 6, 7, and 8 of the Code cover industries with particular installation needs is an especially misleading nonsequiter, in that none of these Code chapters deals in any manner with mining or mining machinery.

The proposal FPN clearly indicates that the mining industry does not ask that any equipment and facilities that are not used ONLY FOR THE PURPOSE OF MINING be excluded from the NEC. In this sense, the mining industry does not request an exemption that has for many years been conferred on utility generation, control, and communication facilities—operations that differ little from the operations of any manufacturing plant engaged in heavy manufacturing.

It is highly debatable whether some types of operations—utility generating stations, for example—should not be covered by the NEC—in that they differ little from operations in any heavy manufacturing industry. However, the very fact that mining safety in all mines—both above and below ground—is administered by MSHA—and safety in all other industries by OSHA—attests to the fact that MINING IS DIFFERENT and cannot reasonably be considered to conform to the electrical equipment and installation requirements for "ordinary" industries.

The FPN of the proposal clearly indicates that the mining industry does not seek NEC exclusion for "ordinary" aboveground operations. The mining industry DOES seek acknowledgement of the fact that aboveground mining equipment is of essence PORTABLE equipment—including the substations that must follow the mining machinery—and should be excluded from the requirements of the NEC in the same manner that railway rolling stock, ships, and motor vehicles are not covered by the NEC.

VOLTZ: The reasons given by CMP-1 for rejecting the proposal contain little to no new documentation from previous rejections of similar proposals submitted for the 1978, 1981, 1984 and 1987 Codes. This proposal (1-5) was made on sound engineering observation and results that were supported by engineers and operating personnel of the mining industry including many member companies of the Chemical Manufacturers Association (CMA).

Most of the reasons given for rejection appear to show a misunderstanding of or lack of knowledge about the codes or regulations governing mining installations. By law, mining installations are governed by the Mine Safety and Health Administration (MSHA). This body has adopted the NEC and is presently working on documentation to state which sections of the Code are not applicable to the mining installations. This could alleviate compliance difficulties. Also, IEEE is in the process of publishing guidelines for surface mining installations. This document is presently being reviewed by representatives of MSHA. Therefore, it would seem that there are adequate laws and guidelines in place covering this subject.

In a misleading comment, the panel cited the fact that Chapters 5, 6, 7 and 8 of the NEC covers industries with particular electrical installation needs but nowhere in these chapters nor in the remainder of the Code are specific requirements dealing with mining or mining machinery. In fact, if required, some Sections of the Code could cause unsafe conditions to exist whereby an indiscriminate shutdown of a motion without regard to location of the various parts of the excavator could cause severe damage to the equipment or personnel injury. It was suggested that the mining industry come forth and write a chapter on installation requirements of mining equipment for the NEC but this would be unnecessary because the rules and regulations for this type of equipment and installations are already in place.

The FPN of the proposal clearly indicates that the mining industry is not asking for exclusion from the NEC of any fixed equipment or ordinary processing facilities that are used in aboveground operations. The mining industry, however, does seek recognition that the aboveground mining equipment is essentially mobile equipment, including the substations and trailing cables that follow the mining machinery, and as such, should be excluded from the requirements of the NEC in the same manner that railway locomotives, ships, motor vehicles, and other mobile equipment are not covered by the NEC.

Log # 1331, 1333, 1334, 1335, 1336, 1342, 1376, 1377, 1382, 1385, 1386, 1387, 1389, 1390, 1391, 1392, 1393, 1396, 1402, 1403, 1406, 1411, 1422, 1423, 1424, 1425, 1431, 1432, 1433, 1436, 1437, 1438, 1445, 1446, 1447, 1506, 1516, 1517, 1518, 1523, 1530, 1539, 1540, 1560, 1561, 1562, 1643, 1644, 1645, 1655, 1656, 1685, 1686, 1693, 1701, 1706, 1732, 1739, 1744, 1745, 1746, 1747, 1754, 1755, 1757, 1773, 1774, 1775, 1776, 1777, 1798, 1804, 1812, 1816, 1825, 1826, 1827, 1834, 1835, 1864, 1868, 1869, 1889, 1892, 1901, 1939, 1943, 1950, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 2114, 2123, 2154, 2155, 2164, 2167, 2219, 2290, 2327, 2328, 2342, 2386, 2403, 2416, 2677, 2729, 2825, 2826, 2879, 3169, 3263, 3266, 3443
1- 6 - (90-2(b)(2)): Reject

SUBMITTER: T. J. Brenner, TJB Inc. (Log #1331)

Theodore E. Hansen, Cable Industrial Cable Co. (Log #1333)

Alan Furniss, Colorado Yampa Coal Co. (Log #1334)

Michael M. Freebourn, Argo International Corp. (Log #1335)

Merritt D. Redick, San Francisco, CA (Log #1336)

Ralph J. Long, Cemsco Inc. (Log #1342)

Randy Kroskob, Kaiser Coal Corporation (Log #1376)

Allen H. Litchfield, Kaiser Coal Corporation (Log #1377)

Frank W. Peak, Evansville, IN (Log #1382)

David E. Famher, General Electric Co. (Log #1385)

Paul Hronich, Middlesex, NJ (Log #1386)

Kenneth A. Polcyn, General Electric Co. (Log #1387)

Clifford Lundstrum, General Electric (Log #1389)

David Shibata, Kiewit Mining Group Inc. (Log #1390)

Gary Lee Sloan, Arch of Wyoming - Seminoe II Mine (Log #1391)

John C. Klingler, P&M Coal Co. - Colonial Mine (Log #1392)

W. E. Ketch, Amax Coal (Log #1393)

William J. Kibler, K & J Coal Co Inc. (Log #1396)

John Fred Rivera, Kaiser Coal Corp. and WMEA (Log #1402)

Donald L. Giacomo, Kaiser Coal Corp. of York Canyon (Log #1403)

Stephen L. Warren, Peabody Coal Company (Log #1406)

Randy Gates, San Juan Coal Co. (Log #1411)

John A. Sittner, San Juan Coal Co. (Log #1422)

Richard A. Adsero, The Falkirk Mining Co. (Log #1423)

Franz Grasser, Siemens Corp. (Log #1424)

Lloyd L. Seckman, Arch of Illinois, Captain Mine (Log #1425)

William E. Barnhart, Jewett, TX (Log #1431)

William C. Cross, IMC Fertilizer, Inc. (Log #1432)

John H. Shaw, Amax Coal (Log #1433)

H. L. Gleaves, Cordero Mining Co. (Log #1436)

Paul J. Holm, Jr., Delta Mine (Log #1437)

Bill Hubbard, BHP/Utah International (Log #1438)

Hubert W. Myers, Consolidation Coal Co. (Log #1445)

Richard Czubkowski, Harnischfeger Corp. (Log #1446)

Fred Leffler, Golden, Colorado (Log #1447)

Billy Graham, Peabody Coal Company (Log #1506)

George E. Martin, Amax Coal Co., Inc. Ayrshire Mine (Log #1516)

Carol G. Embry, Peabody Coal Co. (Log #1517)

Michael G. Slind, Star Fire Coals, Inc./Cyprus-Mountain Coals (Log #1518)

Daniel S. Hunter, Amax Coal, Delta Mine (Log #1523)

J. Kaszycki, Pittsburgh, PA (Log #1530)

Paul H. Schipke, San Juan Mine BHP-Utah International (Log #1539)

Kenneth A. Kemp, The Pittsburgh & Midway Coal Mining Company (Log #1540)

John Pfisterer, Arch Minerals (Log #1560)

P. T. Schuerman, Erie, PA (Log #1561)

Donald M. Baxter, Drummond Company, Inc. (Log #1562)

Keith Ence, Utah International (Log #1643)

Fred R. Wilson, BHP/Utah Int. Navajo Mines (Log #1644)

Emmit C. Culver, Utah International (Log #1645)

Michael F. Hauch, Cordero Mining Co. (Log #1655)

James A. Cooke, Columbus, OH (Log #1656)

Billy B. Foster, Texas Gulf Chemicals, Inc. (Log #1685)

Larry Casson, Jasper, AL (Log #1686)

Woodrow C. Haase, Dresser Industries, Marion Division (Log #1693)

Jerome R. Endres, Western Mining Electrical Assoc. (Log #1701)

Harold M. Hartley, The Carter Mining Company (Log #1706)

Martin Huslig, Farmington, NM (Log #1732)

Michael Alley, BHP-Utah International (Log #1739)

Robert L. Beyer II, Worthington, OH (Log #1744)

Walter J. Ruzzo, Farmington, NM (Log #1745)

Woodrow C. Haase, Delaware, OH (Log #1746)

Michael M. Tillman, BHP-Utah Minerals, Inc. (Log #1747)

John Jonscher, Adalet PLM (Log #1754)

Raymond M. Sierra, Road Machinery Co. (Log #1755)

Robert M. Davis, Utah International (Log #1757)

C. M. Oliver, Open Pit Mining Association (Log #1773)

E. L. Breece, Marion, OH (Log #1774)

Steve Swaldi, Navasota Mining Co. (Log #1775)

Charles R. Crothers, Amax Coal Co. (Log #1776)

Kenneth L. Adams, Navasota Mining Co. (Log #1777)

Ray W. Townsend, Eastern Electric Apparatus Repair Co. Inc. (Log #1798)

Martin J. Bruckner, Cummins Southwest Inc. (Log #1804)

Harry Talk, Navajo Mine (Log #1812)

David S. King, Siemens Energy and Automation, Inc. (Log #1816)

Roy A. Mydler, Consolidation Coal Co. (Log #1825)

John S. Logan, Consolidation Coal Co. (Log #1826)

David Munson, Pinckneyville, IL (Log #1827)

Kenneth G. Hafner, Columbus, OH (Log #1834)

William J. Horvath, General Electric Co. (Log #1835)

Jim Merchant, Waldo, OH (Log #1864)

David Dean, Salem, VA (Log #1868)

Larry J. Ashby, Amax Coal Co. (Log #1869)
 Larry W. Reese, Amax Coal Co. (Log #1889)
 Kenneth E. Allen, Open Pit Mining Assoc. (Log #1892)
 Frank E. Oslakovic, Page Engineering Co. (Log #1901)
 Kenneth Kellywood, Utah International Inc. BHP Navajo Mine (Log #1939)
 Harry M. Dushac, Carnegie, PA (Log #1943)
 Patrick M. Ryan, Amax Coal Company (Log #1950)
 Mark D. Robison, Utah International (Log #1965)
 William Dale Young, Utah International (Log #1966)
 David W. Robertson, Farmington, NM (Log #1967)
 Thomas L. Dugger, BHP - Utah International Inc. (Log #1968)
 Lynn W. Byers, BHP - Utah International Inc. (Log #1969)
 John W. Grubb, BHP - Utah International, Inc. (Log #1970)
 Walt L. Bedonie, Farmington, NM (Log #1971)
 Eugene M. Getek, Utah International Inc. (Log #1972)
 Robert Harris, Utah International Inc. (Log #1973)
 Kevin M. Compton, BHP - Utah International (Log #1974)
 David Jones, Utah International (Log #1975)
 Charles Goats, Utah International (Log #1976)
 Stanley D. Lewis, BHP - Utah International, Inc. (Log #1977)
 Tod H. Haanes, BHP - Utah International Inc. (Log #1978)
 R. L. Gates, BHP - Utah International Inc. (Log #1979)
 R. Lawrence Petty, UII - Navajo Mine (Log #1980)
 Evan Y. Jones, BHP - Utah International Inc. (Log #1981)
 William Skeet, BHP - Utah International (Log #1982)
 George Theron Easter, Utah International Mining Co. (Log #1983)
 Leslie C. Larson, BHP - Utah Minerals International (Log #1984)
 James R. Minor, Peabody Coal Company (Log #2114)
 Stan Burns, Stan Burns & Associates Inc. (Log #2123)
 Albert Schock, Aurora, CO (Log #2154)
 Patrick T. Enright, La Plata, NM (Log #2155)
 David C. Lousberg, Farmington, NM (Log #2164)
 Ronald J. Arnold, Cyprus Mountain Coals Corp. (Log #2167)
 Dr. Robert H. King, Golden, CO (Log #2219)
 Gerald Badgett, Nauasota Mining Co. (Log #2290)
 Ed Pettigrew, San Juan Coal Company (Log #2327)
 R. R. Nordhagen, Carbon Prds operation of General Elec. Co. (Log #2328)
 Kevin Shields, Peabody Coal Company (Log #2342)
 John Adamson, Peabody Coal Co. - Simco Mine (Log #2386)
 Ray Cessna, Peabody Coal Co. - Gibraltar Mine (Log #2403)
 Bert Serak, Farmington, NM (Log #2416)
 Stanley E. Combs, Arch of Illinois Inc., Horse Creek Mine (Log #2677)
 Henry M. Cherpak, Star Fire Mining Co. (Log #2729)
 William J. Collins, IMC Fertilizer Inc. (Log #2825)
 Gerald F. Crandall, Dresser Industries, Inc., Marion Division (Log #2826)
 Richard L. Evans, Amax Coal Co. (Log #2879)
 Stanley Crosby, Amax Coal Co. (Log #3169)
 Norman E. Brown, Amax Coal Co. (Log #3263)
 David J. Salisbury, The Coteau Properties Co. (Log #3266)
 Thomas Russiello, Phillips Petroleum Co. (Log #3443)

RECOMMENDATION: Revised to read:

Equipment and installations under the exclusive control of a mining company which are used only for the purpose of mining, and where the conditions of maintenance and supervision assure that only qualified persons operate and service the equipment and/or installation.

(FPN) It is the intent that the NEC shall be applicable in the case of buildings used by the mines for purposes other than the mining operation, such as office buildings, warehouses, garages, machine shops, dining facilities, visitor centers, recreational buildings, and permanently fixed processing plants.

SUBSTANTIATION: Electrically driven mining machines, and their power support installations, as used today in surface mining, were essentially developed in the time period between 1940 and 1970. During this time period, the manufacturers of mining machines did not attempt to design their machines to comply with the NEC for three reasons.

ONE - There was not demand from users for a change in design, because of the excellent safety record of surface mining machines.

TWO - From 1940 to 1968, all "installations in mines" were specifically exempted in the scope of the National Electric Code.

THREE - There were no provisions written into the NEC that were intended to cover the special conditions that exist on surface mining machines until the 1975 version of the NEC was printed. The special conditions include such items as high and low voltage ac, high and low voltage dc, grounded and ungrounded circuits, specially designed complete drive circuits, the machine frame completely constructed of steel, and with power and grounding both supplied through a special trailing cable from a remote source that may be within one thousand feet of the machine or may be more than a mile distant from the machine.

In 1968, the mining exemption, in the NEC, was changed from "installations in mines" to "installations underground in a mine." This meant that the special UNDERGROUND mining machines developed between 1940 and 1970 were still exempt but that the special machines developed for surface mines in the same time period would no longer be exempt if an authority having jurisdiction decided to adopt the Code for regulatory purposes.

PL 91-173 was promulgated, by congress, as THE FEDERAL COAL MINE HEALTH AND SAFETY ACT in December 1969. In June 1970, CFR30 part 77 became effective as federal law to regulate surface coal mines. Article 516 of CFR-30 Part 77 adopted by reference, the National Electric Code of 1968, or the most recent version, to apply to all parts of a surface mine on any rule not specifically covered elsewhere in part 77.

Some of the articles and sub sections of the NEC can be applied to mining machines, but many cannot or should not be applied due to either the intent for which the section was written, or just plain non-applicability, (i.e. electric dryers). This did not create a problem in the early years of the regulation, but in the mid 1970s the determination, by MSHA, was made that the NEC, in its entirety, could be applied to the special mining machines. This has resulted in gross misapplications of the NEC. The misapplications, in turn, resulted in increased cost and lost time to the mining industry, without an equivalent increase in safety.

In 1981, the Ad Hoc Sub Committee on mining related subjects, was requested by the Correlating Committee of the National Electric Code, to investigate the applicability of the National Electric Code in its entirety to all parts of a mine not covered by the exemption in the scope to "underground parts of a mine." The Ad Hoc Committee recommended three additional exemptions

ONE - Proposal 1-9 - 90-2(b)(2) - Change to exempt the underground installations in a mine and the equipment and installations located above the surface that are used exclusively in conjunction with the mining operations, and that are under the exclusive control of the mine, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the installation.

TWO - Proposal 1-12 - 90-2(b)(6) - Equipment and installation under the exclusive control of a mining company which are used exclusively for the purpose of surface mining, strip mining, or open pit mining, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment and installation.

THREE - Proposal 1-15 - Installations in mining related tipplers, mills, concentration, beneficiation and preparation plants that are used exclusively in conjunction with a mining operation, that are under the exclusive control of the mine, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment.

The codemaking panel turned down all three proposals, but after objections from many sources, agreed to hold the proposals over for further study in the NEC-TCR-83-A. Most of the reasons listed for rejection appeared to show a misunderstanding of, or lack of knowledge about mining installations. For instance, reference was made to the uncertainty of MSHA adopting

the NEC, when in fact MSHA had adopted the Code in its entirety when the rules were promulgated for surface mines in CFR30, part 77 in 1969. Reference was also made to the slow progress of the IEEE working groups in producing guidelines for mining as a reason for rejection. This is completely irrelevant, in that all types of mining have existed thus far in time without IEEE guidelines. The NEC, in its entirety, is not required for MSHA to function, with respect to mining machines. This is evidenced by the fact that only surface coal regulations reference the NEC in its entirety while all other types and kinds of mining use only a few applicable sections of the NEC. Metal and nonmetal surface and underground installations are very adequately administered by MSHA. There are very few or no contentious issues due to interpretation of the references to the National Electric Code in the metal and nonmetal regulations. In contrast, surface coal has had so many and varied problems that industry has spent thousands of dollars in citation costs, many of which were irrelevant to safety, due to misinterpretation of the NEC.

Meetings between the American Mining Congress and Mines Safety & Health Administration personnel have resulted in mutual recognition that the NEC in its entirety cannot be reasonably applied to mining machines used in the pit to remove overburden and/or win coal. Many hours and dollars have been expended by an already economically strapped industry to go through the National Electric Code, sentence by sentence, to decide which parts are applicable to the machines in the pit and which have no application whatsoever.

From the mining industry's perspective, it is desirable that the exemptions from the NEC be returned to the mining industry to prevent other authorities, with jurisdiction, from inadvertently passing laws that could allow the NEC to be misapplied.

This application for modification takes note of the similarity of the existing NEC exemptions in 90-2(b) to the conditions which prevail in mining. Most exemptions apply to mobile type equipment. The electrically powered mining equipment, used in surface mining, requires exemption for the same reasons other mobile equipment has exemptions. The other main reason for exemption appears to be for the communications and power industries on the premise that they limit access to specific problem areas to qualified personnel only. The mining industry not only restricts many areas from the general public, it is compelled by law to only allow access to all areas dedicated to mining to qualified, trained personnel. Furthermore, these qualified people must periodically undergo retraining to maintain their certification.

In addition, all electrical installations must be marked with suitable "danger" signs, transformer stations enclosed by fences, and gates kept locked against unauthorized entry.

It would appear that special guarding of exposed electrical equipment, limiting access to qualified personnel, and requiring special training to qualify electrical personnel, would justify treating the electrically non-standard areas of a mine to the same status as accorded the power and communications industries in their exemptions.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-5.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Palko, Voltz.

EXPLANATION OF VOTE:

PALKO: Same reason as for Proposal No. 1-5.

VOLTZ: See my comment on Proposal 1-5.

Log # 1434, 1624, 1711, 1756, 1926, 1927, 1928, 1929, 1930

1- 7 - (90-2(b)(2)): Reject

SUBMITTER: T. R. Winterer, BHP - Utah International Inc. (Log #1434)

Paul R. Archibeque, BHP-Utah International-San Juan Coal (Log #1624)

Shel Leibach, Road Mach. Co. (Log #1711)

Gary Weber, Utah International Inc. (Log #1756)

John H. Williams, Cummins Southwest Inc. (Log #1926)

Neva B. Williams, Cummins Southwest Inc. (Log #1927)
Meredith Ketrang, Cummins Southwest Inc. (Log #1928)
Michael E. Mikkelsen, Cummins South West Inc. (Log #1929)

Jack A. Hindman, Cummins Southwest (Log #1930)

RECOMMENDATION: Revised to read:

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(FPN) It is the intent that the NEC shall be applicable in the case of buildings used by the mines for purposes other than the mining operation, such as office buildings, warehouses, garages, machine shops, dining facilities, visitor centers, recreational buildings, and permanently fixed processing plants.

SUBSTANTIATION: Electrically driven mining machines, and their power support installations, as used today in surface mining, were essentially developed in the time period between 1940 and 1970. During this time period, the manufacturers of mining machines did not attempt to design their machines to comply with the NEC for three reasons.

ONE - There was not demand from users for a change in design, because of the excellent safety record of surface mining machines.

TWO - From 1940 to 1968, all "installations in mines" were specifically exempted in the scope of the National Electric Code.

Note: No additional supporting material attached.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-5. The substantiation does not seem to be complete.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Palko, Voltz.

EXPLANATION OF VOTE:

PALKO: Same reason as for Proposal No. 1-5.

VOLTZ: See my comment on Proposal 1-5.

Log # 1541, 1542

1- 8 - (90-2(b)(2)): Reject

SUBMITTER: R. A. Matuszak, Greendale, WI (Log #1541)

G. G. Dinkelman, Bucyrus-Erie Co. (Log #1542)

RECOMMENDATION: Revise as follows:

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(FPN) It is the intent that the NEC shall be applicable in the case of buildings used by the mines for purposes other than the mining operation, such as office buildings, warehouses, garages, machine shops, dining facilities, visitor centers, recreational buildings, and permanently fixed processing plants.

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Some of the articles and sub sections of the NEC can be applied to mining machines, but many cannot or should not be applied due to either the intent for which the section was written, or just plain non-applicability, (i.e. electric dryers). This did not create a problem in the early years of the regulation, but in the mid 1970s the determination, by MSHA, was made that the NEC, in its entirety, could be applied to the special mining machines. This has resulted in gross misapplications of the NEC. The misapplications, in turn, resulted in increased cost and lost time to the mining industry, without an equivalent increase in safety.

In 1981, the Ad Hoc Sub Committee on mining related subjects, was requested by the Correlating Committee of the National Electric Code, to investigate the applicability of the National Electric Code in its entirety to all parts of a mine not covered by the exemption in the scope to "underground parts of a mine." The Ad Hoc Committee recommended three additional exemptions

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The codemaking panel turned down all three proposals, but after objections from many sources, agreed to hold the proposals over for further study in the NEC-TCR-83-A. Most of the reasons listed for rejection appeared to show a misunderstanding of, or lack of knowledge about mining installations. For instance, reference was made to the uncertainty of MSHA adopting the NEC, when in fact MSHA had adopted the Code in its entirety when the rules were promulgated for surface mines in CFR30, part 77 in 1969. Reference was also made to the slow progress of the IEEE working groups in producing guidelines for mining as a reason for rejection. This is completely irrelevant, in that all types of mining have existed thus far in time without IEEE guidelines. The NEC, in its entirety, is not required for MSHA to function, with respect to mining machines. This is evidenced by the fact that only surface coal regulations reference the NEC in its entirety while all other types and kinds of mining use only a few applicable sections of the NEC. Metal and nonmetal surface and underground installations are very adequately administered by MSHA. There are very few or no contentious issues due to interpretation of the references to the National Electric Code in the metal

and nonmetal regulations. In contrast, surface coal has had so many and varied problems that industry has spent thousands of dollars in citation costs, many of which were irrelevant to safety, due to misinterpretation of the NEC.

Meetings between the American Mining Congress and Mines Safety & Health Administration personnel have resulted in mutual recognition that the NEC in its entirety cannot be reasonably applied to mining machines used in the pit to remove overburden and/or win coal. Many hours and dollars have been expended by an already economically strapped industry to go through the National Electric Code, sentence by sentence, to decide which parts are applicable to the machines in the pit and which have no application whatsoever.

From the mining industry's perspective, it is desirable that the exemptions from the NEC be returned to the mining industry to prevent other authorities, with jurisdiction, from inadvertently passing laws that could allow the NEC to be misapplied.

This application for modification takes note of the similarity of the existing NEC exemptions in 90-2(b) to the conditions which prevail in mining. Most exemptions apply to mobile type equipment. The electrically powered mining equipment, used in surface mining, requires exemption for the same reasons other mobile equipment has exemptions. The other main reason for exemption appears to be for the communications and power industries on the premise that they limit access to specific problem areas to qualified personnel only. The mining industry not only restricts many areas from the general public, it is compelled by law to only allow access to all areas dedicated to mining to qualified, trained personnel. Furthermore, these qualified people must periodically undergo retraining to maintain their certification.

In addition, all electrical installations must be marked with suitable "danger" signs, transformer stations enclosed by fences, and gates kept locked against unauthorized entry.

It would appear that special guarding of exposed electrical equipment, limiting access to qualified personnel, and requiring special training to qualify electrical personnel, would justify treating the electrically non-standard areas of a mine to the same status as accorded the power and communications industries in their exemptions.

FOUR - On mobile mining equipment personnel and equipment protection must be totally co-ordinated or unsafe conditions can be designed into the machine in the interest of meeting isolated clauses in a code.

For example: Excavators (shovels, draglines, etc) are mobile mining equipment that utilize adjustable speed drives (usually rotating Ward Leonard D-C drives). The motors powering the main drives are equipped with regulators that limit short circuit current to a value no more than 220% of motor and cable rating and imbedded thermal switches. However, this equipment is not provided with disconnection or even shutdown circuitry (only annunciation) as required by the NEC for several safety reasons.

1) Instantaneous disconnection of the motor from its power source in case of an overload prevents electrical braking of the drive. All excavator drives are high inertia drives and are equipped with mechanical parking and emergency brakes. The drive motors and brakes are located in a confined excavator machinery house. The use of mechanical brakes to actually stop the machinery is discouraged for several reasons and is only used in cases of no alternative emergencies.

a) Smoke from the brakes will fill the machinery immediately after the application of mechanical brakes severely reducing the visibility of hazards for maintenance personnel working within the machinery house.

b) Excavators are machines that shake and vibrate severely. Mechanical brakes require adjustment to insure full braking ability. It is difficult to maintain these adjustments resulting in unreliable braking caused by low brake settings or severe braking caused by high brake settings. The low settings may of course cause collision between the excavator and it's surroundings (ie; highwall, trucks being loaded, bulldozers etc.) The high settings can cause several damage to excavator structures due to high stress build up.

2) Indiscriminate shutdown of a motion (or motions) without regard to location of the various mechanical parts of the excavator can cause severe damage or personnel injury. For example; in a shovel truck loading operation if the shovel hoist becomes overloaded it is not desirable to stop this motion even if it is interlocked with all others since the loaded hoist will be stopped much more quickly than the very high inertia swing motion. Under these conditions the dipper will probable collide with the truck being loaded risking severe equipment damage and/or personnel injury.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-5.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Palko, Voltz.

EXPLANATION OF VOTE:

PALKO: Same reason as for Proposal No. 1-5.

VOLTZ: See my comment on Proposal 1-5.

Log # 1958

1- 9 - (90-2(b)(2)): Reject

SUBMITTER: Allen M. Newcome, Electro-Mechanical Corporation

RECOMMENDATION: Revised to read:

Installation and equipment under the exclusive control of a mining company which are used only for the purpose of mining, and where the conditions of maintenance and supervision assure that only qualified persons operate and service the equipment and/or installation.

(FPN) It is the intent that the NEC shall be applicable in the case of buildings used by the mines for purposes other than the mining operation, such as office buildings, warehouses, garages, machine shops, dining facilities, visitor centers, recreational buildings, and permanently fixed processing plants.
SUBSTANTIATION: Electrically driven mining machines, and their power support installations, as used today in surface mining, were essentially developed in the time period between 1940 and 1970. During this time period, the manufacturers of mining machines did not attempt to design their machines to comply with the NEC for three reasons.

ONE - There was not demand from users for a change in design, because of the excellent safety record of surface mining machines.

TWO - From 1940 to 1968, all "installations in mines" were specifically exempted in the scope of the National Electric Code.

THREE - There were no provisions written into the NEC that were intended to cover the special conditions that exist on surface mining machines until the 1975 version of the NEC was printed. The special conditions include such items as high and low voltage ac, high and low voltage dc, grounded and ungrounded circuits, specially designed complete drive circuits, the machine frame completely constructed of steel, and with power and grounding both supplied through a special trailing cable from a remote source that may be within one thousand feet of the machine or may be more than a mile distant from the machine.

In 1968, the mining exemption, in the NEC, was changed from "installations in mines" to "installations underground in a mine." This meant that the special UNDERGROUND mining machines developed between 1940 and 1970 were still exempt but that the special machines developed for surface mines in the same time period would no longer be exempt if an authority having jurisdiction decided to adopt the Code for regulatory purposes.

PL 91-173 was promulgated, by congress, as THE FEDERAL COAL MINE HEALTH AND SAFETY ACT in December 1969. In June 1970, CFR30 part 77 became effective as federal law to regulate surface coal mines. Article 516 of CFR-30 Part 77 adopted by reference, the National Electric Code of 1968, or the most recent version, to apply to all parts of a surface mine on any rule not specifically covered elsewhere in of part 77.

Some of the articles and sub sections of the NEC can be applied to mining machines, but many cannot or should not be applied due to either the intent for

which the section was written, or just plain non-applicability, (i.e. electric dryers). This did not create a problem in the early years of the regulation, but in the mid 1970s the determination, by MSHA, was made that the NEC, in its entirety, could be applied to the special mining machines. This has resulted in gross misapplications of the NEC. The misapplications, in turn, resulted in increased cost and lost time to the mining industry, without an equivalent increase in safety.

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TWO - Proposal 1-12 - 90-2(b)(6) - Equipment and installation under the exclusive control of a mining company which are used exclusively for the purpose of surface mining, strip mining, or open pit mining, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment and installation.

THREE - Proposal 1-15 - Installations in mining related tipples, mills, concentration, beneficiation and preparation plants that are used exclusively in conjunction with a mining operation, that are under the exclusive control of the mine, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment.

The codemaking panel turned down all three proposals, but after objections from many sources, agreed to hold the proposals over for further study in the NEC-TCR-83-A. Most of the reasons listed for rejection appeared to show a misunderstanding of, or lack of knowledge about mining installations. For instance, reference was made to the uncertainty of MSHA adopting the NEC, when in fact MSHA had adopted the Code in its entirety when the rules were promulgated for surface mines in CFR30, part 77 in 1969. Reference was also made to the slow progress of the IEEE working groups in producing guidelines for mining as a reason for rejection. This is completely irrelevant, in that all types of mining have existed thus far in time without IEEE guidelines. The NEC, in its entirety, is not required for MSHA to function, with respect to mining machines. This is evidenced by the fact that only surface coal regulations reference the NEC in its entirety while all other types and kinds of mining use only a few applicable sections of the NEC. Metal and nonmetal surface and underground installations are very adequately administered by MSHA. There are very few or no contentious issues due to interpretation of the references to the National Electric Code in the metal and nonmetal regulations. In contrast, surface coal has had so many and varied problems that industry has spent thousands of dollars in citation costs, many of which were irrelevant to safety, due to misinterpretation of the NEC.

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It would appear that special guarding of exposed electrical equipment, limiting access to qualified personnel, and requiring special training to qualify electrical personnel, would justify treating the electrically non-standard areas of a mine to the same status as accorded the power and communications industries in their exemptions.

The working group of P795 surface mines of IEEE, I.A.S. mine industries is now reviewing for approval guidelines for surface mining electrical. This should be ready for requested acceptance by IEEE for publication as guidelines at an early date. A copy of this guideline will be provided if requested.

All mining in the United States is under the Code of Federal Regulation Part 30 Mineral Resources. Federal Code Mine Health and Safety Act of 1969 and the Federal Mine Safety and Health Act of 1977 continue published regulations. These regulations are enforced by qualified inspection personnel under the direction of the Department of Labor.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-5.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Palko, Voltz.

EXPLANATION OF VOTE:

PALKO: Same reason as for Proposal No. 1-5.

VOLTZ: See my comment on Proposal 1-5.

Log # 2690

1- 10 - (90-2(b)(2)): Reject

SUBMITTER: Mark G. Ellis, American Mining Congress

RECOMMENDATION: Revised to read:

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THREE - Proposal 1-15 - Installations in mining related tipplers, mills, concentration, beneficiation and preparation plants that are used exclusively in conjunction with a mining operation, that are under the exclusive control of the mine, and where the conditions of maintenance and supervision assure that only qualified persons will operate and service the equipment.

The codemaking panel turned down all three proposals, but after objections from many sources, agreed to hold the proposals over for further study in the NEC-TCR-83-A. Most of the reasons listed for rejection appeared to show a misunderstanding of, or lack of knowledge about mining installations. For instance, reference was made to the uncertainty of MSHA adopting the NEC, when in fact MSHA had adopted the Code in its entirety when the rules were promulgated for surface mines in CFR30, part 77 in 1969. Reference was also made to the slow progress of the IEEE working groups in producing guidelines for mining as a reason for rejection. This is completely irrelevant, in that all types of mining have existed thus far in time without IEEE guidelines. The NEC, in its entirety, is not required for MSHA to function, with respect to mining machines. This is evidenced by the fact that only

surface coal regulations reference the NEC in its entirety while all other types and kinds of mining use only a few applicable sections of the NEC. Metal and nonmetal surface and underground installations are very adequately administered by MSHA. There are very few or no contentious issues due to interpretation of the references to the National Electric Code in the metal and nonmetal regulations. In contrast, surface coal has had so many and varied problems that industry has spent thousands of dollars in citation costs, many of which were irrelevant to safety, due to misinterpretation of the NEC.

Meetings between the American Mining Congress and Mines Safety & Health Administration personnel have resulted in mutual recognition that the NEC in its entirety cannot be reasonably applied to mining machines used in the pit to remove overburden and/or win coal. Many hours and dollars have been expended by an already economically strapped industry to go through the National Electric Code, sentence by sentence, to decide which parts are applicable to the machines in the pit and which have no application whatsoever.

From the mining industry's perspective, it is desirable that the exemptions from the NEC be returned to the mining industry to prevent other authorities, with jurisdiction, from inadvertently passing laws that could allow the NEC to be misapplied.

This application for modification takes note of the similarity of the existing NEC exemptions in 90-2(b) to the conditions which prevail in mining. Most exemptions apply to mobile type equipment. The electrically powered mining equipment, used in surface mining, requires exemption for the same reasons other mobile equipment has exemptions. The other main reason for exemption appears to be for the communications and power industries on the premise that they limit access to specific problem areas to qualified personnel only. The mining industry not only restricts many areas from the general public, it is compelled by law to only allow access to all areas dedicated to mining to qualified, trained personnel. Furthermore, these qualified people must periodically undergo retraining to maintain their certification.

In addition, all electrical installations must be marked with suitable "danger" signs, transformer stations enclosed by fences, and gates kept locked against unauthorized entry.

It would appear that special guarding of exposed electrical equipment, limiting access to qualified personnel, and requiring special training to qualify electrical personnel, would justify treating the electrically non-standard areas of a mine to the same status as accorded the power and communications industries in their exemptions.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-5.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Palko, Voltz.

EXPLANATION OF VOTE:

PALKO: Same reason as for Proposal No. 1-5.

VOLTZ: See my comment on Proposal 1-5.

Log # 2730

1- 11 - (90-2(c)): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Delete this section entirely.

SUBSTANTIATION: This section permits a large jurisdiction adjacent to my jurisdiction to completely disregard Section 310-15 and the new ampacity tables applied to service laterals.

The N.E.C. Sytle Manual Section A-3.b. requires explicit Code language to encourage uniform N.E.C. adoption without alteration. This would imply that Panels No. 1 and No. 6 must reach accord in enforcement requirements concerning these two sections. Otherwise, I will advise my State Board of Building Standards to issue a revision of their N.E.C. adoption.

PANEL ACTION: Reject.

PANEL COMMENT: Present section is needed to cover special situations. The substantiation indicates an administrative problem which is not a Code matter.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1695

1- 12 - (90-4): Reject

SUBMITTER: Jerome M. Frank, Jerome M. Frank and Associates

RECOMMENDATION: Add:

"Where third party certified equipment is available (U.L., Factory Mutual, etc), use of certified equipment shall be mandatory."

SUBSTANTIATION: Unlisted medium voltage transformers, some using unrecognized insulation systems, (i.e., cast coil transformers) are being installed as dry type transformers within buildings and not in fire proof vaults. Ventilated dry type transformers USING 220°C U.L. COMPONENT RECOGNIZED INSULATION SYSTEMS have been proven safe for installation without a fire proof vault, but this is not true for cast coil units made by a variety of manufacturers.

PANEL ACTION: Reject.

PANEL COMMENT: Section 90-6 specifically provides for examination for safety of equipment under standard conditions, as a basis for approval. Section 90-4 already gives responsibility for interpretation and approval of the installation, including equipment.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1696

1- 13 - (90-6): Reject

SUBMITTER: Jerome M. Frank, Jerome M. Frank and Associates

RECOMMENDATION: Add:

"Where third party certified equipment is available (U.L., Factory Mutual, etc), use of certified equipment shall be mandatory."

SUBSTANTIATION: Unlisted medium voltage transformers, some using unrecognized insulation systems that have not been 3rd party certified as fire safe, (i.e. cast coil transformers) are being installed as dry type transformers within buildings and not in fire proof vaults.

Ventilated dry type transformers, using UL and 3rd party certified insulation systems (Class H 220°C) have been the only dry type transformers that could be installed indoors without a fire proof vault.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-12.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3453

1- 14 - (90-7): Reject

SUBMITTER: Paul A. Walach, Derry, NH

RECOMMENDATION: I would like to have adopted a mandatory rule ART 90-7(A) wiring planning, Future expansion and continuance for the installation of service panels and/or lighting and appliance panel boards that serve a dwelling, whether single family or multi-family that may be installed in a residential storage garage that is attached to the dwelling.

"Spare raceways or pull lines shall be installed" into an unfinished utility or basement area. Also spare raceways or pull lines to an accessible attic.

SUBSTANTIATION: With the rise of condominium type housing that have panel boards in residential storage attached garage, it is too easy to violate the building code on fire rated walls when an electrician or home owner has to add more circuits or make additions and not making any repairs for fire rated walls in these areas. Condominium multi-family adjoining units are the worst incidents of fire walls pierced through, such as with NM cable, etc.

Further Note: In my opinion it is a poor practice that electricians wiring in nonconstruction locate service disconnects that also have the branch circuit overcurrent devices located in residential storage ATTACHED garages.

I hope the Code Making Panel can address the designation of a utility area that could have access in some way, to locate panel boards with service disconnecting means outside of a fire rated room such as a garage, with some reasonable other exceptions if not practical such as submain panelboards in living areas.

PANEL ACTION: Reject.

PANEL COMMENT: Present Section 90-7(a) adequately cautions the user regarding future expansions. This requirement is contrary to the purpose of the Code as described in Section 90-1(b), pertaining to adequacy of Code provisions.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1188

1- 15 - (90-8): Reject

SUBMITTER: Elden O. Wood, Wausau, WI

RECOMMENDATION: Revise as follows:

90-8. METRIC UNITS OF MEASURE. For the purpose of this Code metric units of measurement are based on trade sizes and dementions to be used when working in the metric system of measure. The metric values are not identical equivalents to inch-foot-pound values but have been rounded to significant digets and convenient numbers.

(FPN): The 1993 Code will use the metric (SI) values as the prime units of measure.

SUBSTANTIATION: The present application of the metric (SI) system of measure does not take into consideration the effect of significant digits. The product of any two numbers is no more accurate than the least accurate multiplier. i.e. If the dimensions between hangers is rounded off to 4 1/2 ft. the meteric dimension is only accurate to the nearest 15 centimeters.

The fact that this Code retains the arcaic inch-foot-pound system makes it very difficult to apply this Code in the rest of the world

PANEL ACTION: Reject.

PANEL COMMENT: For the purpose of the NEC a soft conversion to approximate equivalent values is adequate. In addition it is consistent with the NFPA policy on metric conversion.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1201

1- 16 - (90-8): Reject

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: Add:

Using the International System of Units (S.I) with the American Wire Gauge (AWG).

SUBSTANTIATION: Proposal recomand, for the future, that the values of measurement of size of conductors in the Code text (AWG units) be followed by an approximate equivalent value in (S.I) units.

1. The units of diameter and cross sections of electrical conductors are very complicated, conforming to the (AWG): using several units such as inch, mil, square inch (sq. in), circular mil (C.M), thousand of circular mil (MCM), gauge numbers, naught, and using 5 or 6 numbers after the decimale

2. Using the gauge number, it is very difficult to have any comprehension of the actual diameter or the cross section of conductors, without the Wire gauge.

3. From an electrical point of view, the cross section is at least, the same importance as temperature. The NEC CODE ases both (Fahrenheit and Celsius).

4. Including conversion for measurement allows for the best use of the NEC CODE, and it helps very much the extention of culture and Science, in addition, it would give American products competitive advantage in the world market.

5. The cross section of round copper rod (f.e) in circular mil (C.M), is more than the real cross section of metal ($1 \text{ in}^2 = 1.273 \times 10^6 \text{ CM}$), circular section is taking for square section.

6. The cross section of flat busbar copper in (C.M) is more than the realcross section, the rectangular cross section is considered like circular section.

7. Finally, for the surprise, the British Wiring Regulations (IEE) uses only the International System of Units (S.I) (meter, kilometer, millimeter, millimeter square, celius degres, kilogram . . .).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-15. In addition, the present units reflect the general usage and terminology in the United States of America.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1682

1- 17 - (90-9-(New)): Reject

SUBMITTER: James N. Pearse, Leviton Manufacturing Company, Inc.

RECOMMENDATION: Add a new Section.

90.9 Frequency of Inspection. Dwelling units shall be inspected for compliance with this Code as required to assure safety. Inspections shall be made for new work, extension of existing circuits, upon change of ownership or occupant, and within three years of the last inspection.

Exceptions: (1) Transient occupancies such as hotels and motels.

(2) Replacement of existing devices.

SUBSTANTIATION: Fires and electrocutions have resulted from failure of electrical systems in dwelling units to comply with Code requirements. This proposal will reduce the number of incidents by requiring periodic electrical inspection of dwelling units by those jurisdictions which choose to adopt the NEC.

A dwelling unit usually has an electrical inspection during rough-in and again after device installation as a requirement for a Certificate of Occupancy. In most cases, this is the last time an electrical inspector ever sees that unit. Over the years, the electrical system will deteriorate, and modifications may be made by do-it-yourself occupants. Contamination can occur on insulating surfaces and lightning strikes may have caused flashover that seriously reduces dielectric strength of wiring or equipment. Wiring devices may be worn or damaged, but continue to be used. 30 ampere fuses may be installed on overloaded 15 ampere circuits, or coins used to bypass over current protection entirely. Extension cords may be installed as fixed wiring. Electrical hazards are the rule rather than the exception as a dwelling unit ages.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: This is an administrative matter to be resolved by the authority having jurisdiction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 100 -- DEFINITIONS

Log # 1037

1- 18 - (Article 100-Accessible (As applied to Equipment); Accessible, Readily): Reject

SUBMITTER: David E. Shapiro, Safety First Electrical Contracting

RECOMMENDATION: Accessible: (As applied to equipment)

Add after "means." The approach shall be via an unobstructed path at least 30 inches (76 cm.) square in cross-section.

Readily accessible:

Add after "etc." The approach shall be via an unobstructed path at least 30 inches (76 cm) wide and 5 feet (152 cm.) high.

SUBSTANTIATION: The definition of "accessible," as it now stands, relies on the general duty "other effective means" to let you at equipment without hazard.

"Readily accessible" relies on the general duty "reached quickly." Having had to crawl around plumbing, underdecks, and through crawlspaces to get at equipment, I would like g.c.'s and other trades put on explicit notice that electricians have normal ergonomic measurements. Right now, it's a fine to do for the inspector to complain of obstructions, usually after every trade has done his installation. Being specific works better. It will make equipment servicing quite a bit easier.

PANEL ACTION: Reject.

PANEL COMMENT: The establishment of precise dimensions only serves to make the Code more contentious and may not serve the needs of all the Code panels who have written requirements based on the present definitions.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3327

1- 19 - (Article 100-Accessible (As applied to Equipment)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise the definition for Accessible: (As applied to Equipment), to read as follows:

PANEL COMMENT: Present Section 90-7(a) adequately cautions the user regarding future expansions. This requirement is contrary to the purpose of the Code as described in Section 90-1(b), pertaining to adequacy of Code provisions.

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(FPN): The 1993 Code will use the metric (SI) values as the prime units of measure.

SUBSTANTIATION: The present application of the metric (SI) system of measure does not take into consideration the effect of significant digits. The product of any two numbers is no more accurate than the least accurate multiplier. i.e. If the dimensions between hangers is rounded off to 4 1/2 ft. the meteric dimension is only accurate to the nearest 15 centimeters.

The fact that this Code retains the arcaic inch-foot-pound system makes it very difficult to apply this Code in the rest of the world

PANEL ACTION: Reject.

PANEL COMMENT: For the purpose of the NEC a soft conversion to approximate equivalent values is adequate. In addition it is consistent with the NFPA policy on metric conversion.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1201

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SUBMITTER: Hayssam Safadi, Tucson, AZ

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7. Finally, for the surprise, the British Wiring Regulations (IEE) uses only the International System of Units (S.I) (meter, kilometer, millimeter, millimeter square, celius degres, kilogram . . .).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-15. In addition, the present units reflect the general usage and terminology in the United States of America.

VOTE ON PANEL ACTION: Unanimously Affirmative.

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Exceptions: (1) Transient occupancies such as hotels and motels.

(2) Replacement of existing devices.

SUBSTANTIATION: Fires and electrocutions have resulted from failure of electrical systems in dwelling units to comply with Code requirements. This proposal will reduce the number of incidents by requiring periodic electrical inspection of dwelling units by those jurisdictions which choose to adopt the NEC.

A dwelling unit usually has an electrical inspection during rough-in and again after device installation as a requirement for a Certificate of Occupancy. In most cases, this is the last time an electrical inspector ever sees that unit. Over the years, the electrical system will deteriorate, and modifications may be made by do-it-yourself occupants. Contamination can occur on insulating surfaces and lightning strikes may have caused flashover that seriously reduces dielectric strength of wiring or equipment. Wiring devices may be worn or damaged, but continue to be used. 30 ampere fuses may be installed on overloaded 15 ampere circuits, or coins used to bypass over current protection entirely. Extension cords may be installed as fixed wiring. Electrical hazards are the rule rather than the exception as a dwelling unit ages.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: This is an administrative matter to be resolved by the authority having jurisdiction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 100 -- DEFINITIONS

Log # 1037

1- 18 - (Article 100-Accessible (As applied to Equipment); Accessible, Readily): Reject

SUBMITTER: David E. Shapiro, Safety First Electrical Contracting

RECOMMENDATION: Accessible: (As applied to equipment)

Add after "means." The approach shall be via an unobstructed path at least 30 inches (76 cm.) square in cross-section.

Readily accessible:

Add after "etc." The approach shall be via an unobstructed path at least 30 inches (76 cm) wide and 5 feet (152 cm.) high.

SUBSTANTIATION: The definition of "accessible," as it now stands, relies on the general duty "other effective means" to let you at equipment without hazard.

"Readily accessible" relies on the general duty "reached quickly." Having had to crawl around plumbing, underdecks, and through crawlspaces to get at equipment, I would like g.c.'s and other trades put on explicit notice that electricians have normal ergonomic measurements. Right now, it's a fine to do for the inspector to complain of obstructions, usually after every trade has done his installation. Being specific works better. It will make equipment servicing quite a bit easier.

PANEL ACTION: Reject.

PANEL COMMENT: The establishment of precise dimensions only serves to make the Code more contentious and may not serve the needs of all the Code panels who have written requirements based on the present definitions.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3327

1- 19 - (Article 100-Accessible (As applied to Equipment)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise the definition for Accessible: (As applied to Equipment), to read as follows:

Admitting close approach: not guarded by elevation or other effective means, or by building, equipment, panelboard, etc. doors or equipment operating handles locked to those to whom is requisite. (See "Accessible, Readily.")

SUBSTANTIATION: It is intuitively obvious that any locked door, whether it be the door to an equipment room, or the door of a panelboard, or any locked equipment handle, effectively guards against a person without the key. The present definition implies, and is frequently so interpreted, that only building doors are being referred to.

PANEL ACTION: Reject.

PANEL COMMENT: The intent of the present definition is to apply to building doors. The definition of Accessible, readily addresses the equipment doors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1218

1- 20 - (Article 100-Appliance Leakage Circuit Interrupter-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 10 and 11 for information.

SUBMITTER: Earl W. Roberts, Reptec

RECOMMENDATION: Add:

Appliance Leakage Circuit Interrupter (ALCI) - A device intended to de-energize the supply to utilization equipment within an established period of time when a leakage current on the load side of the device exceeds a predetermined value.

SUBSTANTIATION: Proposals have been submitted to include reference to Appliance Leakage Circuit Interrupters in Articles 422 and 430. If proposals are accepted for use of this term in more than one Article, it is appropriate that the definition be included in Article 100.

There is no conflict with the applications of existing protective devices as can be seen from the present Article 100. Definitions are given below for reference:

Ground Fault Circuit Interrupter: A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

Ground Fault Protection of Equipment: A system intended to provide protection of equipment from damaging line to ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device.

UL has established a listing classification under the ALCI definition and listed products currently exist under this category.

PANEL ACTION: Reject.

PANEL COMMENT: The Code does not prohibit the use of these devices and CMP 1 does not see any need to include this definition at this time. Refer to CMP 10 and 11 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 335

1- 21 - (Article 100-Basement): Reject

Secretary's Note: It is not necessary to refer this Proposal 1-21 to CMP 2 for action due to CMP 2 action on Proposal 2-135.

SUBMITTER: Richard E. Loyd, Arkansas Department of Labor

RECOMMENDATION: Those areas below grade level not designed to be utilized as habitable rooms or areas as described in Article 210-52: General Provisions; 210-52(c): Bathrooms and 210-52(e): Laundry Rooms, but are designed only for storage or dedicated equipment rooms.

SUBSTANTIATION: Webster's dictionary defines Basement: The part of a building that is wholly or partially below ground level.

Article 210-52(f) and Article 210-70 states one (1) outlet and one (1) light is required.

In many dwellings now being constructed, the below grade space (commonly called "basement") is designed as habitable living space. Many electrical contractors and builders interpret the Code as requiring one outlet and one light, without capacity for meeting the requirements of habitable rooms. Many times these rooms are partitioned off, but left to be finished by the owner, who finds out that the service is too small or that they overloaded existing circuits. I therefore believe that the definition in Webster's dictionary does not meet the N.E.C. needs or intent.

PANEL ACTION: Reject.

PANEL COMMENT: The scope of Article 100 indicates that it is not intended to include commonly defined general terms. Refer to CMP 2 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2392

1- 22 - (Article 100-Branch Circuit Ampere Rating-(New)): Reject

SUBMITTER: Raymond W. Eckardt, Hot Springs, AR

RECOMMENDATION: Add the following:

Branch-Circuit Ampere Rating: The ampere rating of the overcurrent protection or the ampacity of the branch-circuit conductors whichever is the lesser value taking into account any derating factors that apply due to ambient derating factors or number of conductors.

SUBSTANTIATION: Section 210-3 states that branch circuits shall be classified in accordance with the maximum permitted ampere rating or setting of the overcurrent device. The classification of a branch circuit is not used elsewhere in the Code. However Article 210, 220, 422, 424, 550, 551, 555, 600, 610 and 690 refer to or imply a circuit ampere rating. A definition of the branch-circuit ampere rating is needed in the NEC. An Article on this subject was published in the Jan/Feb 1987 IAEI News.

PANEL ACTION: Reject.

PANEL COMMENT: CMP 1 is aware of no problems in applying the referenced articles related to the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1092

1- 23 - (Article 100-Branch Circuits, Multiwire): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 2 and 4 for information.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the fourth line in the definition for Branch Circuit, Multiwire as indicated:

... to the neutral "(grounded)" conductor ...

SUBSTANTIATION: This change is needed to more adequately clarify and simplify the Code meaning/intent because, in accordance with this Code, the neutral and the grounded conductor performs the same/similar functions as indicated in Sections 230-31(c) and 230-42(c). Also, this would do much to minimize confusion and misapplication because in some Code sections the term "neutral" is used and in other sections the term "grounded conductor" is used; for example, in Section 200-2 "grounded conductor" is used and in Section 210-4 "neutral" is used.

PANEL ACTION: Accept.

PANEL COMMENT: Substantiation is incorrect in regards to Section 200-2.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1094

1- 24 - (Article 100-Branch Circuit, Multiwire, FPN-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Branch Circuit, Multiwire definition, add as indicated:

"(FPN): For high-leg voltage to grounded neutral conductor in 4-wire delta-connected systems, see Section 384-3(e)."

SUBSTANTIATION: The voltage between the "grounded neutral conductor" is not always equal as indicated in the existing definition and this change, if approved, will simplify and clarify the Code meaning/intent.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation for the proposal is incorrect because a multiwire branch circuit must have an equal potential difference between each ungrounded conductor, and the grounded conductor must have an equal potential difference between it and each ungrounded conductor of the circuit; otherwise you do not have a multiwire branch circuit.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1040

1- 25 - (Article 100-Cabinet): Reject

SUBMITTER: Raymond Eckardt, Hot Springs Vil., Ark.

RECOMMENDATION: Revise as follows:

Cabinet: An enclosure designed either for surface or flush mounting consisting of an Electric Cabinet Box and an Electric Cabinet Front (Frame, matt or trim) and with or without a swinging door(s). (See "Cutout Box")

SUBSTANTIATION: The enclosures permitted by Section 240-30 Exception No. 3 (so-called "load centers") are not designed so that doors "may be hung", except where they are factory marked to indicate how the field modification is to be made. Use of the terms "Electric Cabinet Box" and "Electric Cabinet Front" which are used in the labeling of these enclosures helps to distinguish these enclosures from Cutout Boxes. See also my proposal for Section 240-30.

PANEL ACTION: Reject.

PANEL COMMENT: The introduction of two undefined terms to describe "cabinet" will not clarify the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2152

1- 26 - (Article 100-Circuit-(New)): Reject

SUBMITTER: Rick L. Gifford, City of Kokomo, IN

RECOMMENDATION: Add:

Circuit - any closed path followed or capable of being followed by an electric current.

SUBSTANTIATION: Note 10 to tables 310-16 through 310-31 Article 100 nor the IEEE Dictionary defines "Circuit" therefore as Mr. Shapiro has pointed out in his proposal, unless circuit is to be interpreted as Branch Circuit by virtue of its location in Code, it then should be applicable to anything that can be used to form a "circuit".

PANEL ACTION: Reject.

PANEL COMMENT: The IEEE dictionary does have a definition of circuit to wit: "A conductor or system of conductors through which an electric current is intended to flow." The stated example in the substantiation is in accordance with this definition. Therefore, the scope of Article 100 does not require commonly defined technical terms to be included in Article 100.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 574

1- 27 - (Article 100-Circuit Breaker): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "injury" to "damage".

SUBSTANTIATION: Editorial. To conform to other more appropriate Code terminology.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1093

1- 28 - (Article 100-Circuit Breaker): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in Circuit Breaker definition as indicated:

... overcurrent without (injury) "damage" to itself ...

SUBSTANTIATION: Editorial. To conform to the terminology as used in this Code.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 859

1- 29 - (Article 100-Circuit Breaker, FPN): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change the second sentence of the FPN under the definition of "Circuit Breaker" to read:

"See definition of 'Switching Devices' in Part B of this article for definition applying to medium-, and high-voltage circuits and equipment."

SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium-, and high-voltage circuits, equipment and systems (Article 100 proposals). The intent of the FPN is not altered by this proposed change.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comment on Proposal 1-80.

Log # 1

1- 30 - (Article 100-Closed Loop Power Distribution-(New); Control Channel-(New); Grounded Conductor Interruption-Detector-(New); Open-Loop Power Distribution-(New); Programmed Power Distribution-(New)): Reject

Secretary's Note No. 1: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for information.

Secretary's Note No. 2: The following two proposals consist of Comments 1-37 and 1-38 on Proposal 1-118 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. These comments were held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 1-118 was to add new definitions as follows:

Closed-Loop Power Distribution: The joint control of local power distribution by a local power system controller and an energy-using device by means of control and acknowledgment signals.

Control Channel: A means of transmitting commands. A control channel may use infrared radiation, frequency modulation of the current carrier, etc., and is therefore distinct from a current-carrying circuit.

Grounded Conductor Interruption-Detector: A device to detect a break in the grounded-conductor path to the ground electrode of the local power distribution system.

Open-Loop Power Distribution: The method of electrical power distribution in which a potential is presented at an outlet or distribution circuit until a protective device opens the circuit upon detection of an overload or ground fault condition.

Programmed Power Distribution: Use of Closed-Loop Power Distribution, waveform converters, and power multiplexing to distribute a specified voltage, current, and frequency of power to utilization equipment.

SUBMITTER: Ad Hoc Subcommittee on Closed Loop and Programmed Power Distribution Systems, NEC Correlating Committee

RECOMMENDATION: Accept in principle.

Revise definition for Closed-Loop Power Distribution to read:

"A premises power distribution system jointly controlled by signaling between the energy controlling equipment and utilization equipment."

SUBSTANTIATION: The revised wording of the definition for Closed-Loop Power Distribution eliminates the word "local" and uses "premise" to more accurately define the system.

A definition for Control Channel is not needed.
Grounded Conductor Interruption-Detector is a phrase that is not used in the text.

Open-Loop Power Distribution is a proposed new term for a conventional wiring system that is not needed. Proposals using this term have been rewritten to remove any reference to open-loop power distribution.

PANEL ACTION: Reject.

PANEL COMMENT: The terms closed-loop and programmed power distribution are adequately covered in the Scope of Article 780. The remaining terms are not used in the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2

1- 31 - (Article 100-Closed-Loop Power Distribution-(New); Control Channel-(New); Grounded Conductor-Interruption-Detector-(New); Open-Loop Power Distribution-(New); Programmed Power Distribution-(New)): Reject

Secretary's Note No. 1: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for information.

Secretary's Note No. 2: See Secretary's Note, Proposal 1-30. The Public Comment from the NAHB Research Foundation was Comment No. 1-39 in the 1986 Annual Meeting National Electrical Code Technical Committee Documentation with the following recommendation:

This proposal should be accepted as proposed by the Ad Hoc Committee on Closed Loop Power Distribution Systems, with the following definition added:

"Energy Controlling Equipment: Equipment which controls or regulate energizing and deenergizing of branch circuit outlets in a closed-loop power distribution system."

SUBMITTER: Richard H. Bamford, Willimantic, CT

RECOMMENDATION: We recommend that this proposal be accepted in the form proposed by the Public Comment from the NAHB Research Foundation.

SUBSTANTIATION: We concur with and endorse the Substantiation given in the Public Comment from NAHB Research Foundation.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-30.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 575

1- 32 - (Article 100-Conduit Body): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "conduit or tubing" to

"conduit, cable, or tubing".

SUBSTANTIATION: Editorial. To include cable systems permitted by Section 300-15.

PANEL ACTION: Reject.

PANEL COMMENT: A conduit body provides access to the interior of the system (interior of the conduit or tubing), and a cable does not fit this definition. Although a conduit body may be used instead of a box for the splicing of conductors or conversion to another wiring method, it is irrelevant to the definition.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 860

1- 33 - (Article 100-Disconnecting Means, FPN): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change the FPN under the definition of "Disconnecting Means" to read:

"(FPN): See definition in Part B of this article for definition applying to medium-, and high-voltage circuits and equipment."

SUBSTANTIATION: Same as Proposal 1-29.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 742

1- 34 - (Article 100-Diversity Factor-(New)): Reject

SUBMITTER: Robert T. Slaymaker, Wilmington, DE

RECOMMENDATION: Add a definition for "Diversity Factor."

Diversity Factor: Is the ratio of the sum of the individual maximum demands of the various parts of a system to the maximum demand of the whole system.

SUBSTANTIATION: Load diversity is a new term referred to in Note 8 (Ampacity Adjustment Factors.) in the Notes to Tables 310-16 through 310-31. The NEC 1987 does not define the term diversity. The definition would clarify what is meant by diversity and eliminate any possible misinterpretation on derating conductors when ten (10) or more are in the same raceway.

PANEL ACTION: Reject.

PANEL COMMENT: The term diversity factor is not used in the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 805

1- 35 - (Article 100-Dusttight, FPN): Accept

SUBMITTER: H. Brooke Stauffer, National Electrical Manufacturers Association

RECOMMENDATION: Revise to read as follows:

(FPN): For test conditions other than for rotating equipment, see ANSI/NEMA 250-1985, Enclosures for Electrical Equipment (1000 Volts Maximum), clause 6.5.

SUBSTANTIATION: Update of referenced standard to indicate current edition.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2866

1- 36 - (Article 100-Electronic Computer/Data

Processing Equipment-(New); Interconnecting

Cables-(New); Power Supply Cables-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 12 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Warren H. Lewis, Lewis Consulting & Computer Power Equipment Mfgs. Assoc.

RECOMMENDATION: Add the following definitions to Article 100 so that wiring methods unique to the use of Electronic Computer/Data Processing Equipment may be defined within the NEC which regulates the use and installation of such wiring and equipment, but does not currently define what it is:

Electronic Computer/Data Processing Equipment. Any electronic digital or analog computer, along with all directly related mechanically, electronically and/or electrically interconnected peripheral, memory, input/output (I/O), Video Display Terminal (VDT), power supply and/or coolant units which are "listed" and which when mechanically combined and electrically and electronically interconnected form an Electronic Computer/Data Processing Equipment System.

Interconnecting Cables: Any factory supplied, "listed" signal, data, control, and/or power cable used to electrically and/or electronically interconnect the various separate units of the Electronic Computer/Data Processing Equipment System. Such cables may carry any combination of ac, dc power and/or signals.

Power Supply Cables: Any factory supplied power cord or cable assembly used for the connection of a "listed" unit of the Electronic Computer/Data Processing Equipment System to its branch circuit "or" to an interconnecting cable from another unit of Electronic Computer/Data Processing Equipment for the purpose of obtaining ac and/or dc operating power for the unit equipped with the power supply cable. Such a cable shall be considered a part of the unit to which it is attached and shall not exceed 15-feet in length.

SUBSTANTIATION: NOTE: These definitions are to be submitted to the committee for the revision of ANSI/NFPA-75, Protection of Electronic Computer/Data Processing Equipment 1981 for inclusion in that publication in an effort to harmonize it with the NEC.

The NEC provides for the installation of Electronic Computer/Data Processing Equipment in computer rooms per Article 645. However, such equipment as described above is not defined in the NEC. Such equipment is

defined in ANSI/NFPA-75, Protection of Electronic Computer/Data Processing Equipment 1981, and to a degree in UL Standard for Safety No. 478, Information Processing and Business Equipment, neither of which are officially recognized by most electrical inspection authorities and which are therefore useless in resolving disputed definitions.

Such equipment as described above is often the subject of spirited debate as to what is and is not a part of the Electronic Computer/Data Processing Equipment System when the subject of electrical inspection arises. Such discussions frequently are directed to selectively making some of the equipment a part of the premises wiring system as opposed to being allowed to remain a part of the Electronic Computer/Data Processing Equipment System in accordance with the terms and conditions of the U.L. listing possessed by the equipment. Such a listing is almost always UL Standard for Safety No. 478, Information Processing and Business Equipment.

Such equipment may also be installed in areas not subject to the application of Article 645 and under these cases the required definitions of such equipment are still required, but are missing from the NEC.

Much equipment and many cables interconnecting the Electronic Computer/Data Processing Equipment System serve nearly identical purposes, but are made by companies other than IBM. Such equipment and interconnecting cables are often discriminated against by well meaning electrical inspection agencies who do not review the equipment and cables provided and installed by IBM because we "All know IBM equipment is computer equipment." As a result, IBM is permitted to enjoy equipment installations and wiring techniques which other vendors of identically listed equipment cannot enjoy. The lack of an agreed to set of definitions of this equipment in the NEC are believed to be the principal method by which such discriminatory decisions may be made by the inspecting authority.

Equipment listed to UL Standard for Safety No. 478, Information Processing and Business Equipment which is "disqualified" by the inspection authority which then permits IBM to install ac power interconnecting cables and MG set based products such as the #3039, unfairly cause financial hardship and marketing harm to the affected vendors and to the end users of such listed equipment. Ordered modifications to the equipment and cabling in order to make it "acceptable," typically creates conflicts with its listing requirement and therefore also creates serious questions of legal liability in the product safety area. These burdens are onerous and unfair.

An area as controversial as this one is is deserving of having some agreed-to definitions placed into the NEC which will serve to preserve the historical position of the Electronic Computer/Data Processing Equipment Industry in a rational fashion. Only listed equipment is under consideration in this proposal to change the NEC. Product safety issues are not known to exist in support of the position of the electrical inspection agencies involved in desiring to reclassify the subject equipment from the category of Electronic Computer/Data Processing Equipment to that of the premises wiring system. The opposite position is factually supported by an unblemished product safety record of over 20 years.

PANEL ACTION: Reject.

PANEL COMMENT: These are not only definitions as they also include mandatory requirements. As noted in the substantiation, the definitions are for the purpose of obtaining acceptance of field installations by authorities having jurisdiction, but clarification should come from Article 645 requirements. The definitions may be unsuitable for other field applications. Refer to CMP 12 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1527

1- 37 - (Article 100-Electronic Computer System-(New)): Reject

SUBMITTER: Joseph Laviano, Valatie, NY

RECOMMENDATION: Add:

Electronic Computer System.* Any electronic digital or analog computer, along with all peripheral, support, memory, programming or other directly associated equipment, records, storage and activities.

SUBSTANTIATION: There is no definition in the NEC of just what constitutes a electronic computer system.

PANEL ACTION: Reject.

PANEL COMMENT: Inadequate substantiation to warrant the new definition.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 576

1- 38 - (Article 100-Existing-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add new definition:

"Existing. Construction and/or installation which has a final approval of the authority having jurisdiction."

Or alternatively . . . "That which has been constructed or installed and in use."

SUBSTANTIATION: This term is not defined. Does existing mean the immediate state of being or is a time or condition factor involved? This term is used in numerous sections e.g., 210-7(d), 210-9 Exception No. 2, 220-31, 220-35, 250-24(a) Exception No. 2, 250-50(b), 364-23, 370-12, 380-8(a) Exception No. 2 and (b), 384-16(a), 680-6(b)(1) Exception No. 1, etc.

The City of Los Angeles has found it expedient to define this term in its electrical code.

PANEL ACTION: Reject.

PANEL COMMENT: Panel feels the rules in the sections where the term is used are very clear, as "Existing" is an explanatory word used to denote an installation or piece of equipment already in place.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2393

1- 39 - (Article 100-Feeder Circuit Ampere Rating-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for information.

SUBMITTER: Raymond W. Eckardt, Hot Springs, AR

RECOMMENDATION: Add the following:

Feeder-Circuit Ampere Rating: The ampere rating of the overcurrent protection or the ampacity of the feeder conductor whichever is the lesser value taking into account any derating factors or number of conductors.

SUBSTANTIATION: Although Articles 215 and 220 do not use the term "feeder-circuit ampere rating" Section 215-3 refers to Part A of Article 240 where the terms 50 ampere circuits etc. are used. It seems therefore that some of the rules imply a feeder-circuit ampere rating. See also my proposal for a branch-circuit ampere rating definition.

PANEL ACTION: Reject.

PANEL COMMENT: This definition may not be applicable for all applications, nor has it been proven to be necessary for application of the Code rules. See CMP 1 Panel Comment to the companion proposal for "Branch Circuit Ampere Rating."

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2936

1- 40 - (Article 100-Fire Hazard Analysis-(New)): Reject

SUBMITTER: L. Bruce McClung, Union Carbide Corporation

RECOMMENDATION: Include definition in Article 100 as follows:

Fire Hazard Analysis: A means of determining the impact of a proposed product on hazard to life when involved in a fire.

SUBSTANTIATION: It is common for the safety of building materials, as for example interior finish materials required by NFPA 101, Life Safety Code, Section 6-5, Interior Finish, pp 101-30, 101-31, to be rated on the combined considerations of flame spread and smoke generated. The National Electrical Code has usually defined fire safety only on the basis of flame spread. One important exception is the recent NEC classification in NFPA 70, National Electrical Code, Article 800-3, pp 70-669 70-700, of low-smoke-producing

wire and cable intended primarily for air plenum and related installations. In concert, architects, manufacturers, installers, safety inspectors, and regulatory agencies are giving more attention to the hazards of smoke in a broad spectrum of electrical applications.

In "Measuring Hazards of Products of Combustion from Electrical Systems," FIRE JOURNAL, September/October 1987, pp 108-109, J.E. Snell illustrates several examples of potential fire scenarios that may produce smoke toxicity hazards, as reiterated in Table 1. This article makes an interesting point: "even though electrical systems account for only a small fraction of the total mass of materials in a building, they may be among the items significantly involved in a fire." It follows, therefore, that even when generic materials are commonly used in building furnishings such as wall coverings and furniture, their performance and hazards nonetheless may need to be judged under separate, more stringent criteria when used in electrical applications.

It has been suggested (J.E. Snell, "Measuring Hazards of Products of Combustion from Electrical Systems," FIRE JOURNAL, September/October 1987, pp 108-109) that new products should be evaluated on the basis of an overall fire hazard analysis which addresses the following criteria:

- Ease of Ignition
- Rate of Flame Spread
- Contained Fuel Value and Rate of Energy Release
- Smoke Density

It is noted that key criteria defining Smoke Density are addressed in "Reduced Emissions Material", i.e., a separate proposal submitted under Article 100 - Definition. These criteria should be measured by test methods and governed by specifications using standards germane to the intended application.

These criteria may eventually be combined in the fire hazard analysis by defining the context of proposed materials used, identifying the fire scenarios of concern, developing a quantitative estimate of the magnitudes of hazards to life, and evaluating the consequences.

Adoption of this proposal will allow fire safety alternatives in the choice and installation of nonmetallic materials in electrical construction and result in substantial improvement in safety for people, including firefighters, in areas impacted by fire.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: This term is not used in the Code. The Scope of Article 100 includes definitions of those terms appearing in the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2474

1- 41 - (Article 100-Grounded Conductor): Reject

SUBMITTER: Tracy Walker, Grand Rapids, MI

RECOMMENDATION: Revise Article 100/Grounded Conductor to add the following wording at the end of the definition:

See Article 100/Neutral Conductor.

SUBSTANTIATION: Grounded Conductor & Neutral Conductor refer to the same conductor for wording of Article 230-42(c) and should be so designated in the definitions.

PANEL ACTION: Reject.

PANEL COMMENT: All grounded conductors are not neutral conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2494

1- 42 - (Article 100-Grounded Conductor): Reject

SUBMITTER: Kenneth R. McIntyre, Grand Rapids, MI

RECOMMENDATION: Revised text:

Grounded Conductor "(Neutral)": A system or circuit that's intentionally grounded.

SUBSTANTIATION: Having the word neutral besides the words Grounded Conductor gives a clearer understanding of that definition. Also you do not have neutral listed in Article 100- definitions.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-41.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3328

1- 43 - (Article 100-Grounded, Effectively): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 5 and 16 for information.

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise the definition of "Grounded, Effectively", to read as follows:

Grounded Effectively: Permanently connected to earth through a ground connection of sufficiently low impedance and having sufficient ampacity that ground-fault current which may occur cannot result in voltages dangerous to personnel.

SUBSTANTIATION: The definition as now stated is grammatically and technically unsound, i.e., current cannot "build up to" voltage.

PANEL ACTION: Accept.

PANEL COMMENT: It should be in Part B. Refer to CMP 5 and 16.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Summers.

EXPLANATION OF VOTE:

SUMMERS: The term is only used in Section 800-2(c)(1), FPN, and it is consistent with the defined term in the IEEE Dictionary.

Log # 66

1- 44 - (Article 100-Grounding-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After grounding electrode conductor, "Add:

"Grounding: A conducting path from circuits, metallic enclosures or equipment to earth or a conducting medium.

SUBSTANTIATION: This term should be added since it is a commonly-used term and it is also a frequently used procedure in the electrical trades.

PANEL ACTION: Reject.

PANEL COMMENT: The term "grounding" is generic and is used to describe application of the requirements of Article 250 and other portions of the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2653

1- 45 - (Article 100-Hotels-(New)): Reject

SUBMITTER: Patricia B. Horton, Allied Tube & Conduit Corporation

RECOMMENDATION: Add definition for hotels, as follows:

Includes buildings or groups of buildings under the same management in which there are more than 15 sleeping accommodations for hire, primarily used by transients who are lodged with or without meals, whether designated as a hotel, inn, club, motel, or by any other name. So-called apartment hotels shall be classified as hotels because they are potentially subject to transient occupancy like that of hotels.

SUBSTANTIATION: To correlate with proposal on 331-4. This definition is from NFPA 101-Life Safety Code.

PANEL ACTION: Reject.

PANEL COMMENT: Not in conformance with the scope of Article 100.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1221

1- 46 - (Article 100-Immersion Detection Circuit Interrupter-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 10 and 11 for information.

SUBMITTER: Earl W. Roberts, Reptec

RECOMMENDATION: Add:

Immersion Detection Circuit Interrupter (IDCI) - A device intended for the protection of personnel that

functions to de-energize the supply circuit to an accidentally water-immersed appliance within an established period of time. Circuit interruption occurs when a liquid causes a conductive path between a live part and a sensor, and the resultant current flow between the live part and the sensor exceeds a predetermined value.

SUBSTANTIATION: Proposals have been submitted to include reference to Immersion Detection Circuit Interrupters (IDCI) in Articles 422 and 430. If proposals are accepted for use of this new term in more than one Article, it is appropriate that the definition be included in Article 100.

There is no conflict with the applications of existing protective devices as can be seen from the present Article 100. Definitions are given below for reference:

Ground Fault Circuit Interrupter: A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

Ground Fault Protection of Equipment: A system intended to provide protection of equipment from damaging line to ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device.

UL has established a listing classification under the IDCI definition and listed products currently exist under this category.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-20.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3456

1- 47 - (Article 100-Intrinsic Safety, Equipment-(New) and Intrinsically Safe, System-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 14 and 16 for information.

SUBMITTER: Don C. Jewett, The Upjohn Company

RECOMMENDATION: Add:

Intrinsic Safety, Equipment: Equipment in which the circuits are not necessarily intrinsically safe themselves, but which affect the energy in the intrinsically safe circuits and are relied upon to maintain intrinsic safety. (NFPA 493-1973, 1-4.3)

Intrinsically Safe, System: Approved equipment and wiring that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific flammable or combustible atmospheric mixture in its most easily ignitable concentration.

Abnormal conditions shall include accidental damage to any field-installed wiring, failure of electrical components, application of overvoltage, adjustment and maintenance operations, and other similar conditions. (500-2)

SUBSTANTIATION: Article 100 Definitions for Intrinsic Safety, Equipment and Intrinsically Safe, System are necessary to identify them as separate entities for discussion purposes.

These definitions are more recognizable to users of the National Electrical Code than present terminology used by Instrument Society of America and NFPA 493-1979 to describe this equipment.

PANEL ACTION: Reject.

PANEL COMMENT: Intrinsically Safe Circuit is defined in NFPA 493 and Section 500-2 of the NEC and in accordance with the Scope of Article 100 is suitable for application with the NEC. Refer to CMP 14 and CMP 16 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1301

1- 48 - (Article 100-Location; Moist Location-(New)): Reject

SUBMITTER: William Winglar, Grandville, MI

RECOMMENDATION: Under location add the following definition:

Moist Location: A location subject to a high degree of moisture for an extended length of time.

SUBSTANTIATION: Other parts of the Code such as paragraph 336-3(b) refer to moist locations. Inasmuch as damp, dry and wet locations are defined then moist should also be defined.

PANEL ACTION: Reject.

PANEL COMMENT: It is not the intent of Article 100 to include commonly defined general terms.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2404

1- 49 - (Article 100-Location; Submerged

Location-(New); Wet Location): Reject

SUBMITTER: William E. Slater, Raco Inc.

RECOMMENDATION: Revise present wet location definition and add new submerged location definition.

Wet Location - Installations in concrete slabs or masonry in direct contact with the earth and locations subject to saturation with water or other liquids.

Submerged Location - Installation where covered with water or other liquids to a limited depth.

SUBSTANTIATION: This proposal clarifies two distinct product applications:

(1) Locations where subject to saturation with liquids where no head pressure is present;

(2) Locations where covered with liquids and subject to a head pressure.

This proposal also correlates with a proposal to revise Section 370-5.

PANEL ACTION: Reject.

PANEL COMMENT: The Submitter has given no substantive comments why the definition of wet location should be changed. The term "Submerged" is a commonly defined general term that does not require further clarification in the NEC, as stated in the scope of Article 100.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3434

1- 50 - (Article 100-Long-Time Rating-(New)): Reject.

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 12 and 17 for information.

SUBMITTER: George J. Foster, Western Reserve Division IAEI

RECOMMENDATION: Shift to Article 100, Definitions, Part A.

Long-Time Rating: A rating based on an operating interval of 5 minutes or longer.

SUBSTANTIATION: Same as Proposal 1-79.

PANEL ACTION: Reject.

PANEL COMMENT: The definition of Long-Time Rating is applicable to x-ray equipment, but may be unsuitable to apply to all contexts in which the term may be used. Refer to CMP 12 and CMP 17 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3433

1- 51 - (Article 100-Mobile-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 12 and 17 for information.

SUBMITTER: George J. Foster, Western Reserve Division IAEI

RECOMMENDATION: Shift to Article 100, Definitions, Part A.

Mobile: X-ray equipment mounted on a permanent base with wheels and/or casters for moving while completely assembled.

SUBSTANTIATION: Same as Proposal 1-79.

PANEL ACTION: Reject.

PANEL COMMENT: The term "Mobile" should not be defined in a single context. It is already quite adequately defined for the context in which it is used. Refer to CMP 12 and CMP 17 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3436

1- 52 - (Article 100-Momentary Rating-(New)): Reject
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 12 and 17 for information.

SUBMITTER: George J. Foster, Western Reserve Division IAEI

RECOMMENDATION: Shift to Article 100, Definitions, Part A.

Momentary Rating: A rating based on an operating interval that does not exceed 5 seconds.

SUBSTANTIATION: Same as Proposal 1-79.

PANEL ACTION: Reject.

PANEL COMMENT: The term "momentary rating" should not be defined in a single context. It is already quite adequately defined for the context in which it is used. Refer to CMP 12 and CMP 17 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2291

1- 53 - (Article 100-Neutral Conductor): Reject

SUBMITTER: Bill Eklund, City of Creston, IA

RECOMMENDATION: Add: Definition

"Neutral conductor: The grounded conductor."

SUBSTANTIATION: To clarify, simplify and to eliminate redundant wording in discussion and rules.

PANEL ACTION: Reject.

PANEL COMMENT: All neutral conductors are not always grounded. See Section 250-5. This is a commonly defined technical term in related standards and in accordance with the Scope of Article 100 is suitable for use in the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1633

1- 54 - (Article 100-Neutral Point-(New) and Article 100-Neutral Conductor): Reject

SUBMITTER: Joseph Misrahi, Metropolitan Transit Authority of Harris County

RECOMMENDATION: Add the following definitions:

NEUTRAL POINT. The point at a transformer secondary or a generator winding having equal potential to all transformer secondary or generator terminals. On a delta-connected transformer secondary, the grounded mid-point is the neutral point.

NEUTRAL CONDUCTOR. The circuit conductor connected to the neutral point.

SUBSTANTIATION: Article 100 refers to Note 10 to Table 310-16 through 310-31 for a definition of Neutral Conductor.

There is no definition of Neutral Conductor in Note 10 to Table 310-16 through 310-31 or in any other Article of the National Electrical Code.

"Neutral Conductor" is used in several Articles and should be defined so there is no doubt of which conductor is referred to.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-53.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3089

1- 55 - (Article 100-Nonincendive Circuits-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 14 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Art Hopmann, Killark Electric Manufacturing Company

RECOMMENDATION: Add the definition for non-incendive circuits. Nonincendive circuits - circuits in which any arc or thermal effect produced under intended operating conditions of the equipment is not capable, under specified test conditions of igniting the specified flammable gas-or vapor-air mixture.

SUBSTANTIATION: The term nonincendive in relation to circuits is used in Article 501-3(b)(1)c, and is not completely defined.

PANEL ACTION: Reject.

PANEL COMMENT: If needed in the Code, it should be included in Article 501. Refer to CMP 14 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3088

1- 56 - (Article 100-Nonincendive Components-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 14 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Art Hopmann, Killark Electric Manufacturing Company

RECOMMENDATION: Add the definition for nonincendive components.

Nonincendive Component. A Component having contacts for making or breaking an incendive circuit and the contacting mechanism or the enclosure in which the contacts are housed is constructed so that the component is not capable of igniting the surrounding specific flammable gas- or vapor-air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere.

SUBSTANTIATION: The definition for nonincendive component is presently not in the Code. A proposal is being submitted to Article 501-3(b)(1)d that introduces nonincendive components.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-55.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1038

1- 57 - (Article 100-Panelboard): Reject

SUBMITTER: K. L. Paape, Asheville, NC

RECOMMENDATION: Revise the parenthetical remark under the definition of "Panelboard" to read:

(See "Motor Control Center" and "Switchboard".)

SUBSTANTIATION: A question in litigation has arisen regarding the application of Section 240-21, Exception No. 2, to a motor control center because although panelboard and switchboard are mentioned in sub-paragraph d, motor control center is not.

A definition for "motor control center" has been proposed for Article 100 which states that a motor control center is a specialized form of panelboard.

PANEL ACTION: Reject.

PANEL COMMENT: The definition of motor control center has not been submitted. See FPN in Section 110-16(f).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1823

1- 58 - (100-Pit or Depression): Reject

Secretary's Note: The Correlating Committee does not agree with the Panel Comment to refer this proposal to CMP 14.

SUBMITTER: Ronald K. Melott, Melott and Associates, Inc.

RECOMMENDATION: Add new definition

"Pit or depression: A confined area below floor level which does not exceed 200 sq. ft. in area and is not considered to be a story by the building official."

SUBSTANTIATION: An area which is substantial in area and volume and classified as a story by the building official should not be considered as a pit for the application of Article 500. Otherwise all electrical wiring in basements in buildings which may have service garages at grade level entry must be totally classified as Class I Division I.

PANEL ACTION: Reject.

PANEL COMMENT: This proposal is not a definition. Whether the area should comply with Article 500 or not is the purview of CMP 14. Refer to CMP 14 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 773

1- 59 - (Article 100-Plenum-(New)): Accept

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: Add the following definition:

Plenum. A compartment or chamber to which one or more air ducts are connected and which forms part of the air distribution system.

SUBSTANTIATION: The undefined term "plenum" is used in many places in the Code. Examples are in Sections 300-22, 725-38(b)(1), 760-2(b), 760-28(c), 770-2(b), 770-6(a), 800-3(b)(1) and 820-15. In context, these uses are intended to apply where the plenum distributes environmental air. The proposed definition is intended to clarify the meaning of the term "plenum" and is the same as the definition in NFPA-90A, except for the addition of "air" to differentiate from electrical ducts.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3435

1- 60 - (Article 100-Portable-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 12 and 17 for information.

SUBMITTER: George J. Foster, Western Reserve Division IAEI

RECOMMENDATION: Shift to Article 100, Definitions, Part A.

Portable: X-ray equipment designed to be hand carried.

SUBSTANTIATION: Same as Proposal 1-79.

PANEL ACTION: Reject.

PANEL COMMENT: The definition of portable as applied to x-ray equipment may be unsuitable for all contexts in which the term may be used. Refer to CMP 12 and CMP 17 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1461

1- 61 - (Article 100-Premises Wiring (System)): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 5 and 12 for information.

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: In Article 100 revise end of first sentence of definition of Premises Wiring (System) to read:

"... which extends from the load end of the service drop, or load end of the service lateral conductors, or source of a separately derived system to the outlet(s)."

SUBSTANTIATION: The rules covering premises wiring need to be applied to systems supplied by separately derived sources as well as systems supplied by services.

PANEL ACTION: Accept.

PANEL COMMENT: Send to CMP 5 and CMP 12 for information.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Borleis, Seelbach, Voltz.

EXPLANATION OF VOTE:

BORLEIS: To include a 'separately derived system' in the definition of 'premises wiring system' is wrong and contradictory because, by definition, a 'separately derived system' is an isolated system with NO DIRECT ELECTRICAL CONNECTION to a 'premises wiring system'. Each is a different type of system. A 'premises wiring system', by definition, ends at the outlets (direct quote from the definition). Therefore, if an entirely

separate system is isolated from the 'premises wiring system' by use of an MG set, an isolation transformer, or an alternator with no direct connection to the premises wiring system, such a system is separately derived and stands on its own. An isolation transformer which has its secondary isolated from its primary and which supplies a separate system is separately derived even though the primary side of the transformer receives its source from an outlet of the premises wiring system because the 'premises wiring system' end at its outlets.

The FPN of Section 250-5 states "an on-site generator is not a separately derived system if the neutral is solidly interconnected to a service-supplied system neutral". As counter then, an on-site generator is a separately derived system if its neutral IS NOT INTERCONNECTED to a service-supplied system neutral. How then can a separately derived system be a part of a premises wiring system because if the two systems are interconnected, there is no separately derived system. Likewise, if the two systems are entirely isolated from one another, each is separate (no interconnection) and one cannot be part of the other.

SEELBACH: There is a significant difference of opinion concerning the appropriateness of this proposed change in definition. The change would declare many secondary circuits in computer rooms, premises wiring and cause those secondary circuits to be subject to all Code provisions applicable to separately derived systems, contrary to present practices. In my opinion, a change of definition is not the proper procedure to address this important matter. I understand CMP 12, who is responsible for Article 645, has agreed that their efforts to address this issue in their rewrite of Article 645 have not been adequate. I also understand they are initiating work jointly with CMP-5 and plan to have provisions to technically address the issue processed for publication in the 1990 Edition either in Article 250 or Article 645.

VOLTZ: This proposal (1-61) revises the existing definition of premises wiring (system) to include separately derived systems. This definition would now encompass all such systems including electronic computer/data processing equipment. Under the proposed rewrite of Section 645, subsection 645-15 Grounding, listed electronic computer/data processing equipment shall not be considered a separately derived system. As such, the definition adopted by CMP-1 fails to clearly define the line of demarcation between the premises wiring and the electronic computer/data processing interconnecting wiring which is not internal to the enclosures of this equipment as is done in Section 645.

If the present wording were to remain, an exclusion could be included by a reference to Section 645 for Electronic Computer/Data Processing Equipment or by adding the additional wording to the last sentence of the paragraph as proposed by Warren Lewis in Proposal 1-65 - "Such wiring does not include wiring internal to appliances, motors, controllers, motor control centers and similar equipment such as, but not limited to, listed electronic computer/data processing equipment and the associated listed power supply and interconnecting cables". This revised wording would alleviate compliance difficulties for the electronic computer/data processing industry.

Log # 577

1- 63 - (Article 100-Premises Wiring (System)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 5 and 12 for information.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise first sentence:

"That interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all of its associated hardware, fittings, and wiring devices, both permanently and temporarily installed, which extends from a separately derived system, or from the load end of the service drop, or from the load end of the service lateral conductors, to the outlet(s)."

SUBSTANTIATION: The present definition does not encompass separately derived systems such as generators or solar-charged batteries which have no connection to the load end of the service drop or service lateral conductors. Section 250-5(d) is not a definition of a premises wiring system and appears to be incorrect in assuming a (self-contained) generator system is a premises wiring system per definition.

A similar proposal was accepted in the 1987 TCR then rejected in the TCO, apparently based on objections from the data processing industry whose concern was in regard to the grounding aspects of separately derived systems. This has no bearing on the proper definition and should be resolved on its own merits.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The intent of the proposal is accomplished by the Panel Action on Proposal 1-61. Send to CMP 5 and CMP 12 for information.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Borleis, Seelbach, Voltz.

EXPLANATION OF VOTE:

BORLEIS: Same comment as Proposal 01 061.

SEELBACH: See my comment on Proposal No. 01-061, Log 1461.

VOLTZ: See my comment on Proposal 1-61.

Log # 680

1- 64 - (Article 100-Premises Wiring (Systems)):
Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 5 and 12 for information.

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Revise end of first sentence to read:
"... service drop, load end of the service lateral conductors, "or load end of the separately derived source(s)" to the outlet(s)."

Note: Added material in quotations.

SUBSTANTIATION: The NFPA NEC Handbook states that premises wiring includes wiring that extends from the source of a separately derived system, however, the literal text does not support this statement. This is especially true if the separately derived system is that of an on-site generation system that has no SERVICE DROP or SERVICE LATERAL CONDUCTORS by nature of the fact that there is no utility service. The definition of Premises Wiring should make clear that such an installation is indeed covered by the NEC. Presently, the argument can be made that if there is no service drop or service lateral, then there is no Premises Wiring, as such wiring by its definition must extend from a service drop or lateral. This problem is increasing as more local small generators are installed in buildings to feed electrical systems that may not have any interconnection to the service, even through a transfer switch. A large data processing power system is a good example of such a system.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The intent of the proposal is accomplished by the Panel Action on Proposal 1-61. Send to CMP 5 and CMP 12 for information.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Borleis, Seelbach, Voltz.

EXPLANATION OF VOTE:

BORLEIS: Same comment as Proposal 01 061.

SEELBACH: See my comment on Proposal No. 01-061, Log 1461.

VOLTZ: See my comment on Proposal 1-61.

Log # 2864

1- 65 - (Article 100-Premises Wiring System): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 5 and 12 for information.

SUBMITTER: Warren H. Lewis, Lewis Consulting and Engineering

RECOMMENDATION: It is proposed that the definition of a "Premises Wiring System" be amended to INCLUDE LISTED Electronic Computer/Data Processing Equipment and its directly associated and LISTED power supply and LISTED interconnecting cabling in the presently enumerated

list of EXCLUSIONS from a premises wiring system. Such amendment corrects what appears to be an accidental omission and to reflect past, current and future standard wiring practices as provided for when using Electronic Computer/Data Processing Equipment which is listed to UL Standard for Safety No. 478, Information Processing and Business Equipment. Unlisted equipment is not affected by this requested change.

Accordingly, the following text (in quotations) is requested to be added to the present last sentence of the paragraph containing the definition of a premises wiring system:

Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment "such as, but not limited to, listed Electronic Computer/Data Processing Equipment and the associated listed power supply and interconnecting cables."

SUBSTANTIATION: There is a continuing, historical, and well publicized and visible problem between some electrical inspection agencies and many manufacturers of listed Electronic Computer/Data Processing Equipment related to determining where the line of demarcation exists between the end of the premises wiring system and the beginning of the Electronic Computer/Data Processing Equipment system's wiring.

The most visible products in question are generically referred to as "Computer Power Centers" (i.e., CPCs) or Power Distribution Units (i.e., PDUs). These machines employ only wiring means which are factory assembled and listed as a part of a moveable and easily reconfigurable Electronic Computer/Data Processing Equipment system as opposed to being field assembled from unrelated and basic electrical materials which are required to be made an immovable and fixed part of the building.

Failure to clearly define the line of demarcation between these two forms of wiring and equipment has led and continues to lead to several well meaning electrical inspection agencies enforcing selective bans on the disputed equipment unless it is severely modified and made a fixed part of the building's wiring system as opposed to being allowed to be installed in accordance with the terms and conditions of its listing. Such modifications are not ordered in consistent fashion between the various inspection agencies and are also not known to have ever been based upon any actual electrical safety problems which can be quoted as reason for the required modifications. In fact, the reverse is demonstrably true.

Selective and discriminatory interpretations by the foregoing electrical inspection agencies unfortunately leaves very similar equipment located within the same location unchallenged and free to be installed in normally accepted and competitively advantageous fashion. There are no modifications EVER ordered to this other very similar equipment, and therefore certainly none which cause it to become a part of the fixed portion of the building wiring system (i.e., the "premises wiring system"). In fact, repeated attempts at encouraging the inspection agencies to become familiar with this other equipment and to thus become knowledgeable of the similarities have been generally rebuffed and so have not proven fruitful. This is a highly perplexing situation to those being affected by the interpretations.

Examples of equipment suffering from the foregoing selective discrimination are identified as being any suitably listed product NOT manufactured by IBM, and NOT bearing its nameplate, but which may contain a (or any combinations of) transformer, motor-generator, inverter, or simple bus-bar system with suitable overcurrent devices and which primarily distributes electrical power to OTHER units of the Electronic Computer/Data Processing Equipment system. This equipment may also process, store and divulge data in electronic fashion and may be electronically interconnected to one or more of the OTHER units comprising the overall Electronic Computer/Data Processing Equipment System, but is not always required to do so by the specific application. Additionally, the equipment in question is always suitably listed to UL Standard for Safety No. 478, Information Processing and Business Equipment, and no other equipment is a part of this application's examples.

Specific vendors of such disputed equipment are identified as follows: Emerson Electric Corporation (Liebert Corporation and Computer Power Systems Corporation), Power Distribution Incorporated, Unisys Corporation (Burroughs and Sperry Univac, combined), Honeywell Inc., Control Data Corporation, Exide Corporation, Topaz/DDP Inc., Controlled Power Corporation, and several others.

Unaffected equipment of a similar nature is manufactured by IBM and bears IBM's label. Such equipment may contain a motor-generator and/or any ac power distribution function which is primary to the purpose of the product as opposed to the processing of "data." SOME limited specific examples of such "exempted" equipment would be Models #3047, #3089 and #3067. All of these items distribute ac power via flexible interconnecting cable assemblies which are listed to UL Standard for Safety No. 478, Information Processing and Business Equipment, the same listing used for the disputed equipment.

The principal nature of the major objections to the disputed equipment being redefined from that of Electronic Computer/Data Processing Equipment to a part of the premises wiring system stem from the view that because the products MAY contain a transformer or motor-generator they must be called "separately derived ac systems," which are NEC defined as being a premises wiring system. Further, the equipment is typically accused of containing a "panelboard" which is being used as a means of supplying branch circuits which are being "disguised" as Electronic Computer/Data Processing Equipment interconnecting cables. Finally, connection of the disputed equipment to the building's source of supply is often by electrical connector set (i.e., plug and receptacle) and this is deemed to be a prohibited practice as connector sets cannot be employed on feeders, only on branch circuits. Direct connection to the ac supply is also viewed as a connection to a feeder, not to a branch circuit although such connections are permitted to be made to branch circuits by both the NEC and by U.L. Either way is a loss.

The resultant nature of the subsequently ordered modifications are: (1) To remove any existing input ac supply connector set and make a direct connection to the building's ac supply source as a "feeder" form of connection, or to recognize such an existing connection as a feeder interface; (2) To reclassify the listed flexible output ac power interconnecting cables as premises wiring "branch circuits" and to require them to be secured in place as provided for in other sections of the NEC, and; (3) To force grounding of the product to the nearest available ac system grounding electrode as required by Section #250-26 using permanently installed grounding means. Subsequently, all wiring and the installation of the disputed product are then perceived to be part of the building and may not then be installed by persons not licensed for such work in the community enforcing the modifications.

Thus, in a related series of moves the disputed product is not permitted to be treated as other very similar equipment listed to the same U.L. Standard for Safety is permitted to be treated. Factory personnel are typically enjoined from being allowed to install or move their own products, but may watch IBM install its similar products which have not been singled out for such discriminatory handling by the local electrical inspection agency. Further, the modifications render the affected equipment to be very much less attractive to the purchaser who would economically and otherwise benefit from the use of a flexible wiring means for his entire Electronic Computer/Data Processing Equipment system which must now be "fixed in place" by the requirements for securing all disputed cables in place.

This foregoing situation represents an overall and chilling effect on the efforts of the disputed equipment's vendors to competitively market their product in an environment which does not consistently interpret the NEC's requirements in discriminatory fashion and does not recognize the efficacy of the equipment's existing and legitimate product safety listing. It provides unfair advantage to IBM as a firm uniquely permitted to use similar wiring methods and designs for equipment without penalty. The situation is therefore an onerous and unjustified burden on both

the manufacturer of the disputed equipment, the vendor, and the end user of such equipment. All of this is without one publicly identified safety problem related to the use of the disputed equipment as it is and has been installed and operated in a national manner, since about 1969.

All of the indicated disputed and non-disputed Electronic Computer/Data Processing Equipment is listed to the same standard (i.e. UL Standard for Safety No. 478, Information Processing and Business Equipment). The listed equipment is required by this standard to be connected only to an ac branch circuit. Connections of equipment listed to the indicated standard to feeders or directly to panelboards is not permitted.

The NEC defines feeders as "All conductors between the service equipment or the source of a separately derived ac system and the FINAL branch-circuit overcurrent device." All equipment listed to UL Standard for Safety No. 478, Information Processing and Business Equipment is connected only to a branch circuit, feeders are not directly used.

The NEC defines a "panelboard" as being " . . . designed to be placed in a cabinet or cutout box PLACED IN OR AGAINST A WALL OR PARTITION and accessible only from the front." The NEC definition of a panelboard cannot therefore be applied to a circuit breaker bus-bar and overcurrent device installations located WITHIN the enclosure of listed load/utilization equipment. By further and consistent logical inference, panelboards also may not be fed from a branch circuit, only from a feeder.

The NEC defines the Separately Derived AC System as being a PREMISES WIRING SYSTEM. The Premises Wiring System's definition cannot be logically applied to equipment connected to a branch circuit in accordance with the terms and conditions of the product's product safety listing and the NEC's current wording, without first modifying the products classification by selective interpretation of the NEC to cause it to be connected to a feeder instead of a branch circuit and to then apply fixed ac system grounding means to it. Rejection of its listing category is inherent in this process leaving the equipment in a product safety listing limbo. This process alone has SERIOUS product liability legal implications which are highly undesirable.

Accordingly, a defense is made against this overly intrusive, illogical, and unwanted selective interpretation of the NEC by noting that the U.L. listing status is recognized and otherwise is already provided for in the current edition of the NEC. This defense is logically based upon the fact that the outlet end of the branch circuit is the final portion of the premises wiring system after which load (i.e., utilization) equipment is connected.

Per the foregoing, load/utilization equipment connected to a branch circuit cannot logically be identified as being a continuation of the premises wiring system without destroying the validity of both the U.L. listing process and the pre-existing definitions used in the NEC for a premises wiring system, a branch circuit, a feeder, a panelboard, utilization equipment, and finally a separately derived ac system which is strictly defined in Section #250-26 as being a " . . . premises wiring system. . .)

Therefore, the basic defense is based upon the very unlikely and unreasonable view that for the selective interpretation view to prevail, it would have to be recognized that U.L. itself will need to be judged as having strategically erred in originally classifying such equipment (including IBM's) as branch circuit connected "load/utilization" equipment under UL Standard for Safety No. 478, Information Processing and Business Equipment, when some other standard for safety should have been used. This error would have been nationally promulgated from the earliest origins of the standard and would be continuing into the foreseeable future with no sign of reversal or correction on the part of U.L. In the overall context of U.L.'s development for its Standards for Safety, it is also noted that all such standards are subject to a severe technical review cycle which is heavily participated in by the various electrical inspection agencies, some of which are members of the group encouraging and performing the selective interpretations referred to herein.

Also, selective interpretation of the NEC as outlined above and as applied to an integrated and sensitive electronic system as regards to the "Grounding" of such equipment in rigidly described and fixed manners to randomly selected grounding electrodes, is well known to cause general reductions in the overall reliability of the affected electronic systems. This is a natural and unavoidable result of having uncontrollable grounding connections which allow the introduction and circulation of common-mode "noise" currents through the grounded and grounding conductors used on the Electronic Computer/Data Processing Equipment system. These concerns are not erected herein as a justification for any grounding which is factually unsafe such as "single-point," "ungrounded," "floating," "isolated," "dedicated" and other forms of unsafe grounding which are not permitted by U.L. in any case.

Therefore, per the foregoing, fears expressed by some well-meaning and concerned electrical inspection agencies that shock and ground-fault current problems will exist if fixed grounding to local electrodes is not done per all of the provisions of Section 250-26, have no historical or other factual basis. This view is based upon three undisputable, interlocking facts: (1) UL Standard for Safety No. 478, Information Processing and Business Equipment requires that solid grounding of all internal ac supply windings (150 vrms to ground, or less) be used within the listed equipment and which supply interconnecting cables. This includes grounding/bonding between the identified/grounded conductor, the equipment's metal frame/enclosure, and any related metal shields or metallic raceways surrounding power conductors exiting/entering the equipment, and; (2) A well designed Equipment Safety Grounding Conductor (ESGC; i.e., "greenwire") system is required to be provided and to be solidly grounded/bonded to the identified/grounded conductor of the associated internal ac system, and; (3) it is always required that there shall be a properly installed and coordinated overcurrent device system protecting all current carrying conductors supplying interconnecting cables.

Accordingly, listed equipment to UL Standard for Safety No. 478, Information Processing and Business Equipment is by consensus, therefore not considered to be either a shock or a fire hazard. As a result, in the absence of SIGNIFICANT factual data indicating otherwise, no need exists for further efforts at grounding and bonding as might be required for typical building wiring systems of generally unknown overall characteristics, which may change in completely uncontrolled fashion with time, serve completely undefined loads at any time, serve any remote areas in the building, and which are not subject to U.L.'s intensive scrutiny in any case.

Therefore, no useful purpose is seen to stem from reclassifying the disputed equipment into a category such as a "Premises Wiring System," or as a "Separately Derived AC System." However, if such a NATIONALLY RECOGNIZED reclassification is to occur, it must logically and consistently apply to a broad range of products including IBM's, and not be applied selectively to some products of similar nature, but not of IBM's manufacture. Additionally, significant rewording of the NEC would need to be undertaken in several places if such a reclassification were to be capable of being upheld in logical and/or legal fashion, as the present wording of the NEC does not support the reclassification viewpoint.

Finally, in defense of the past and current industry recognized and common practices, NEC Sections 90-6, Examination of Equipment for Safety (in its entirety) and #110-3(a) and (b) are invoked as supporting evidence in favor of the current listing and installation practices which are being unreasonably disputed by some well-meaning inspection agencies. These agencies are simply not following these sections for unknown reasons.

If the NEC does not require revision as indicated in this request, the the CMP reviewing this request should flatly state which position prevails, and not simply reject the application.

The Sub-Committee to CMP 12 working for the revision of Article 645, Electronic Computer/Data Processing Equipment, is already on record as supporting two related views: (1) That listed Electronic

Computer/Data Processing Equipment shall not be considered to be a separately derived system, and; (2) That power cables, communication cables, connecting cables, interconnecting cables, and associated boxes, connectors, plugs, and receptacles that are listed as a part of, or for, Electronic Computer/Data Processing Equipment shall not be required to be secured in place.

The first of the foregoing positions is principally supported by reference to the last sentence of the first paragraph in Section #250-5 which permits, but does not require grounding of some systems (UL Standard for Safety No. 478, Information Processing and Business Equipment takes care of the specific grounding requirements so the result is not an ungrounded system as some fear). The latter recommendation is completely supported by the exception to Section #300-11, Securing and Supporting.

Because the actions of the Sub-Committee to CMP 12 working for the revision of Article 645, Electronic Computer/Data Processing Equipment, apply only to wiring WITHIN a "computer room" as defined by that article, the changes outlined in this request are absolutely required to extend to the remainder of the facility the same benefits as enjoyed within the computer room, and to further clarify an existing and highly controversial interpretational question as outlined in this application where the equipment is installed in ANY area.

In performing its works, the Sub-Committee to CMP 12 working for the revision of Article 645, Electronic Computer/Data Processing Equipment has noted that ANSI/NFPA-75, Protection of Electronic Computer/Data Processing Equipment 1981 is apparently in complete agreement with the taken position and made recommendations. A specific reference is made to the note to Paragraph 7-2, Electrical Service in this document where it is clearly stated that " . . . The requirements in this section apply to all power and service wiring supplying the electronic computer equipment. THEY DO NOT APPLY TO WIRING AND COMPONENTS WITHIN THE ACTUAL EQUIPMENT OR TO WIRING CONNECTING VARIOUS UNITS OF EQUIPMENT. THE EQUIPMENT AND INTERCONNECTING WIRING REQUIREMENTS ARE SET FORTH IN CHAPTER 4."

Also, in ANSI/NFPA-75, Protection of Electronic Computer/Data Processing Equipment 1981, specific reference is made to Paragraph 1-5, Definitions re the following terms: Electronically Interconnected, Interconnecting Cables, Listed, Shall and Should. Further reference is made to Paragraphs 4-1, Computer Equipment, 4-1.1, 4-1.2, and 4-1.3. The use and recognition of equipment listed to UL Standard for Safety No. 478, Information Processing and Business Equipment is clearly enumerated herein.

In reaching its recommendations the Sub-Committee to CMP 12 working for the revision of Article 645, Electronic Computer/Data Processing Equipment also noted that UL Standard for Safety No. 478, Information Processing and Business Equipment historically and currently EXCLUDES from eligibility for listing from the standard per Paragraphs 1.4 and 1.4(D) " . . . equipment that is associated with but EXTERNAL TO THE INFORMATION-PROCESSING EQUIPMENT OR SYSTEM, AND IS A PART OF THE BUILDING FACILITIES. The following are examples of equipment not covered: . . . Electrical power-supply equipment that is installed separately from a unit or system (for example: BUILT-IN MOTOR/GENERATOR SETS, TRANSFORMERS, AND BRANCH CIRCUIT SUPPLY WIRING).

Thus as an example, a motor/generator may be listed as equipment other than Electronic Computer/Data Processing Equipment OR as Electronic Computer Data/Processing Equipment under UL Standard for Safety No. 478, Information Processing and Business Equipment, at the REQUEST OF THE EQUIPMENT'S ORIGINAL EQUIPMENT MANUFACTURER (OEM). Accordingly, the construction of the product changes significantly as the conditions of listing are changed, and the OEM assumes whatever additional cost burden the selected listing requires. In the case of equipment listed to UL Standard for Safety No. 478, Information Processing and Business Equipment, this is not inconsiderable as the standard is most restrictive and difficult to meet as compared to some others. It is a good example of a worst-case requirement standard in response to conservative design requirements.

Use of a listed product in both modes is not possible without DUAL LISTING with the most restrictive listing's requirements prevailing in all cases. Without dual listing, the two are not directly interchangeable. The original equipment manufacturers (OEMs) for the disputed equipment have chosen to be listed to UL Standard for Safety No. 478, Information Processing and Business Equipment so that they may have the products installed as Electronic Computer/Data Processing Equipment. They should not be penalized for having made this decision while IBM is not.

In closing, it is inconceivable that the NEC would be allowed to be written (interpreted?) in such manner so as to place it so clearly at odds with related standards such as ANSI/NFPA-75, Protection of Electronic Computer/Data Processing Equipment 1981 and UL Standard for Safety No. 478, Information Processing and Business Equipment. It is equally undesirable (and unwarrantable) to permit the maintenance of continued confusion and conflict as capitalized upon by several well-meaning electrical inspection agencies whose actions are chaotic to the manufacturer's and users of the disputed equipment, and unfairly advantageous to another. Harmonization of the indicated sections and articles into one, easily understood set of interlocked "rules" which recognize historical precedent, an unblemished product safety record for nearly 20-years, and accepted industry practice can be easily accomplished by accepting this application's recommendation.

PANEL ACTION: Reject.

PANEL COMMENT: The issue should be addressed on its own merits, rather than the reasons given in the substantiation; i.e. "listed" vs. "unlisted" equipment. Send to CMP 5 and 12 for information.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Voltz.

NOT VOTING: Palko.

EXPLANATION OF VOTE:

VOLTZ: See my comment on Proposal 1-61.

EXPLANATION OF NOT VOTING:

PALKO: I am abstaining from the voting because I feel that the issue is one of degree. Listed equipment is available which is, in fact, the equivalent of a major substation on wheels—and this fact does not change simply because the equipment is "portable" and fitted for plug-in connection. On the other hand, I would not wish to have underdesk UPS units for personal computers classed as premises wiring.

Log # 2094

1- 66 - (Article 100-Raceway): Reject

SUBMITTER: Wayne Harju, Galson & Galson, P.C.

RECOMMENDATION: Revise as follows:

Raceway: An enclosed channel designed expressly for holding wires, optical fibers, cables, or busbars, with additional functions as permitted in this Code.

(FNP): Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible metal conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, optical fiber raceways, wireways, and busways.

SUBSTANTIATION: A client of ours wishes to market a raceway system designed expressly and only for optical fibers.

PANEL ACTION: Reject.

PANEL COMMENT: The NEC does not cover raceways solely containing optical fiber cables. See scope of Article 770.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 578

1- 67 - (Article 100-Raceway, FNP): Accept in Part

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Delete "metal" in the phrase "liquidtight flexible metal conduit" or add "liquidtight flexible nonmetallic conduit".

SUBSTANTIATION: To specifically encompass nonmetallic types in the listing.

PANEL ACTION: Accept in Part.

Delete "metal" in the phrase "liquidtight flexible metal conduit".

PANEL COMMENT: Editorial, this produces the more simplified text.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3186

1- 68 - (Article 100-Raceway): Accept in Principle

SUBMITTER: Charles W. Forsberg, The Carlon Company

RECOMMENDATION: Add to the fine print note under the definition of Raceway, after "liquidtight flexible metal conduit", "liquidtight flexible nonmetallic conduit."

SUBSTANTIATION: Liquidtight flexible nonmetallic conduit has been included in the National Electrical Code since 1981. It is appropriate to include this product in the description of raceways.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 1-67. CMP 1 prefers to cover both products using the generic term.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2937

1- 69 - (Article 100-Reduced Emissions

Materials-(New)): Reject

SUBMITTER: L. Bruce McClung, Union Carbide Corporation

RECOMMENDATION: New text:

Reduced Emissions Materials: Materials that when pyrolyzed or combusted, produce low levels of smoke.

SUBSTANTIATION: Various proposals will call for changes in the 1990 NEC in relation to "reduced emissions" during the pyrolysis or combustion of electrical construction materials.

Smoke and the hazards associated with smoke are increasingly relevant factors in public awareness of fire safety. The MGM Grand, Beverly Hills Supper Club, and the Yonkers Department Store fires are recent examples of fires resulting in fatalities attributed to smoke. Other fires, such as the riser cable fire at the World Trade Center produced extensive smoke and property damage and could have resulted in personal injury had it occurred at high occupancy times. Smoke obscures vision. Smoke irritates and corrodes. Smoke impedes safe egress. Smoke contributes to victim disorientation, excitation and incapacitation. Statistics from several sources including the U.S. Fire Administration; M. Birky's, "Fire Fatality Study, FIRE MATERIAL, 1979, 3:211-217; and J. Loke and R.A. Matthay's, "Managing Victims of Smoke Inhalation," JOURNAL OF RESPIRATORY DISORDERS, 1981, 2:87-98, show that 70 to 80% of fire victims actually succumb from smoke inhalation, not the fire itself.

It is common for the safety of building materials, as for example interior finish materials required by NFPA 101, Life Safety Code, Section 6-5, Interior Finish, pp 101-30, 101-31, to be rated on the combined considerations of flame spread and smoke generated. The National Electrical Code has usually defined fire safety only on the basis of flame spread. One important exception is the recent NEC classification in NFPA 70, National Electrical Code, Article 800-3, pp 70-699, 70-700, of low-smoke-producing wire and cable intended primarily for air plenum and related installations. In concert, architects, manufacturers, installers, safety inspectors, and regulatory agencies are giving more attention to the hazards of smoke in a broad spectrum of electrical applications. It seems reasonable to test electrical materials for flame retardant as well as low-smoke-producing characteristics the same as other building materials.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: There is no substantiated need for this definition as the term is not used in the NEC. In accordance with the scope of Article 100, technical terms from related Codes and Standards are acceptable for general usage without requiring a companion definition in the NEC.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Palko.

EXPLANATION OF VOTE:

PALKO: This proposal should be accepted in principle, because the reason for rejection is no longer valid. CMP Panels 6 and 7 have accepted the use of the term "low smoke" to designate the types of materials described in the submitter's proposed definition for "reduced emissions materials." Cables insulated and/or jacketed with such materials will be permitted to be identified by the suffix LS—for example, Type THHN cable manufactured with low smoke-emitting materials will now be permitted to be identified as Type THHN/LS.

Compounds for manufacturing such wire and cable—and/or wire and cable produced with such compounds—are presently available from at least ten sources:

- Brand Rex (wire and cable)
- Cables (compounds and wire and cable)
- Collyer (wire and cable)
- Dow Chemical (compounds)
- Dupont (compounds)
- Kabl-X (wire and cable)
- Pirelli (compounds and wire and cable)
- Raychem (wire and cable)
- Rockbestos (compounds and wire and cable)
- Union Carbide (wire and cable)

The new LS designation will appear in NEC Tables 310-13, 310-61, and 402-2, and in articles 333, 334, 337, 339, and 340. The proposal should therefore be accepted in principle with this modification: "Low Smoke Materials: Materials that when pyrolyzed or combusted produce low levels of smoke."

COMMENT ON VOTE:

SEELBACH: While I agree with the Panel Action to reject this particular definition, "low smoke" and "low flame" code proposals continue to be made for many parts of nonmetallic wiring systems. These include wire insulation, conduit, tubing, and boxes. It would seem helpful that some common term should be used to identify such products to assist users of the code as these new products evolve.

Log # 2890

1- 70 - (Article 100-Rho): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 6 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Donald W. Zipse, West Chester, PA

RECOMMENDATION: New text:

Rho: A measurement of the thermal resistivity of soil in terms of degrees centigrade centimeters per watt, C°-cm/W, units.

SUBSTANTIATION: Definitions of the term "Rho" is not readily available. Neither the Webster's Dictionary nor the ANSI/IEEE Std 100-1984, "IEEE STANDARD DICTIONARY OF ELECTRICAL and ELECTRONICS TERMS" offers a definitions for RHO applicable to "THERMAL RESISTIVITY".

Calls to two university's civil engineering departments when unanswered. A chemical company's technical librarian could not find the term. A call by her to an "expert" had the "expert" asking, "What??" Only a call to (Name Deleted) produced the units for the term.

Since the CODE uses the term, Rho in Figure 310-1, and since the definition is not readily available, the term Rho should be included in Article 100 - Definitions.

PANEL ACTION: Reject.

PANEL COMMENT: The definition would be more appropriate where the term appears in the Code. Refer to CMP 6 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 579

1- 71 - (Article 100-Service Raceway): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"The raceway that encloses the service-entrance or service lateral conductors."

SUBSTANTIATION: There may be no service-entrance conductors where service lateral conductors are installed, or there may be a transition point where service-entrance conductors extend from service lateral conductors. The present definition does not include the raceway enclosing the service lateral conductors. If not a service raceway, what is it?

PANEL ACTION: Reject.

PANEL COMMENT: The definition is appropriate as presently stated. Although the substantiation points out that service laterals are not covered under the present definition no field problems are cited.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Borleis.

EXPLANATION OF VOTE:

BORLEIS: The proposer is correct and the Panel is incorrect. The present definition of 'Service Raceway' is not complete because a service raceway contains the service conductors which, in an underground system, are those conductors extending from the service equipment to the street main or to the supply transformer. Service conductors include not only the service entrance conductors but, also in the case of an underground system, the service lateral as well. The definition for a service raceway would more appropriately be, 'The raceway that encloses the service conductors.'

Log # 774

1- 72 - (Article 100-Smoke-(New)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: Add the following definition:

Smoke. The airborne solid and liquid particles and gases evolved when a material undergoes pyrolysis or combustion.

SUBSTANTIATION: The Ad Hoc Subcommittee is proposing that the term "products of combustion," where used in the 1987 Code, be change to "smoke," as recommended by the NFPA Committee on Air Conditioning in Public Comment 1-104 for the 1987 Code and by the NFPA Toxicity Advisory Committee in Public Comment 3-95 for the 1987 Code. The Ad Hoc Subcommittee believes that the term "smoke" needs definition in Article 100 and that the definition should be identical to the definition in NFPA-90A, as referenced in the Toxicity Advisory Committee Public Comment. See Ad Hoc Subcommittee proposals for Sections 300-21, 725-2(a), 760-2(a), 770-2(a), 800-3(c) and 820-14 for proposed changes to "smoke."

PANEL ACTION: Reject.

PANEL COMMENT: Smoke is adequately defined in Webster's dictionary. The proposal to add "invisible" gases is not appropriate and would have a major impact on other articles of the NEC; e.g. Section 760-4(d), 800-3(d) and 820-15 which contain the term "low smoke producing characteristics".

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3329

1- 73 - (Article 100-Substation, Unit-(New)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Add the following definition and FPN:

Substation, Unit: A coordinated assembly of a transformer with one or both of a primary and/or secondary protective section (also commonly known as load center or power center).

(FPN): See NEMA Pub. Nos. 201-1970 and 210-1970 for further information on primary and secondary unit substations.

SUBSTANTIATION: Use of such equipment is very common. Certain limitations and exceptions involved in their use are included in other proposals by submitter which, if accepted, would require a formal definition of the involved equipment. Further, the term "unit substation" is presently used in Section 710-24(a) in an over-600 volts context only. The vast majority of unit substations are secondary substations. A general definition would remove the over-600 volts context and facilitate future NEC revisions relating to unit substations.

PANEL ACTION: Reject.

PANEL COMMENT: The scope of Article 100 does not require the inclusion of commonly defined technical terms from related Codes and Standards, into Article 100.

The term substation, unit is defined in other Standards. Hence the scope of Article 100 does not require its inclusion into the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2619

1- 74 - (Article 100-Switches, Transfer Switch-(New)); Bypass Isolation Switch-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add new text:

TRANSFER SWITCH: A transfer switch is a device for transferring one or more load conductor connections from one power source to another.

(FPN) A transfer switch may be automatic or nonautomatic.

BYPASS ISOLATION SWITCH: A bypass isolation switch is a manually operated device used in conjunction with a transfer switch to provide a means of directly connecting load conductors to a power source, and of disconnecting the transfer switch.

SUBSTANTIATION: The addition of the above definitions helps clarify equipment as referred to in Articles 230, 517, 701 and 702. Furthermore, adding these definitions would provide better harmonization with NFPA 99, NFPA 110, NEMA standard ICS 2-447, Underwriters Laboratories standard UL 1008 and IEEE/ANSI standards 100-1984, 446-1987 and 602-1986. Other submitted proposals recommend that the terminology transfer switch and/or bypass isolation switch be included in Articles 230, 517, 700 and 701. The term transfer switch is currently used in Article 517-44 (b) and Article 517-60 (a) (4).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-73. In addition, the term "bypass isolation switch" does not appear in the NEC.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: The key terms to be introduced are BY-PASS ISOLATION SWITCH, not defined in IEEE Dictionary but now accepted by Code Panels 4 and 15, and NON-AUTOMATIC AND AUTOMATIC. The latter, two, cannot be introduced without introducing TRANSFER SWITCH, even though the term is defined elsewhere. The terms automatic and non-automatic have been defined in separate NFPA publications and for that matter there has been confusion between the two, to the point where automatic transfer switches have been forced to carry the label non-automatic. In addition, NEMA believes the original substantiation is still adequate.

Log # 3330

1- 75 - (Article 100-Switchgear, Metal-Enclosed-(New)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Add the following new definition:

Switchgear, Metal-Enclosed: Equipment similar to a switchboard, except built to standards applying specifically to metal-enclosed switchgear. Except as otherwise indicated, all provisions of this code applying to switchboards shall also apply to metal-enclosed switchgear.

SUBSTANTIATION: Metal-enclosed switchgear is mentioned in and regulated by the NEC, but is not yet defined.

PANEL ACTION: Reject.

PANEL COMMENT: Switchgear is defined in other related Standards. Hence, the scope of Article 100 does not require its duplication in the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1095

1- 76 - (Article 100-Switching Devices, Oil Switch): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the last line in the definition as indicated:

... askarel or other (suitable) liquid)(.)

"identified for the purpose."

SUBSTANTIATION: The use of the term "suitable" can/does result in an infinite variety of different Code interpretations/actions being used/applied in ways that could cause ineffective, undesirable or disastrous results. It is, therefore, strongly recommended that, in the interest of Code-required levels of safety, compliance and uniformity, the term "identified" be used because it more adequately defines the requirements needed to ensure the establishment/maintenance of Code-mandated standards that are essential to the safeguarding of persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: It is unlikely that this additional language would be useful to manufacturers or others that utilize such liquids. Product specifications adequately describe the intended uses of the product.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 718

1- 77 - (Article 100-Thermal Cutout): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 4 and 11 for comment.

SUBMITTER: K. L. Paape, Asheville, NC

RECOMMENDATION: Delete the definition of "Thermal Cutout".

SUBSTANTIATION: Thermal cutouts are obsolete products that have not been manufactured for over 50 years. The latest reference in application literature is 1932, (H. D. Braley "Application of Thermal Cutouts to Motor Protection", POWER, January 12, 1932), where their initial cost was two to three times that of ordinary renewal-type cartridges of equivalent rating. Thermal cutouts were superseded by resettable overload relays that required no renewable links, occupied less space, and opened all ungrounded lines to the motor by acting upon a manual or magnetic contactor.

The Code should not be cluttered with obsolete technology. Companion proposals to delete "Thermal Cutouts" from Sections 240-9, 240-40, and 430-40 have been submitted.

PANEL COMMENT: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 855

1- 78 - (Article 100-Transfer Switch-(New)): Reject

SUBMITTER: Rene' Castenschiold, LCR Consulting Engineers, P.A.

RECOMMENDATION: Add:

Transfer Switch: A transfer switch is a device for transferring one or more load conductor connections from one power source to another.

(FPN) A transfer switch may be either automatic or nonautomatic.

SUBSTANTIATION: NFPA 70-1987 does not include a definition for transfer switch even though the term is used in paragraphs 517-44(b), 517-60(a)(4), 517-60(b)(1) and diagram 517-60(3). Transfer equipment is also included in Articles 700 and 701. The above definition harmonizes with similar definitions in NFPA 110, IEEE Standard 100-1984, IEEE Standard 446-1987 and NEMA Standard ICS 2-447.

PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 1-74.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Kitzantides.
EXPLANATION OF VOTE:
KITZANTIDES: See NEMA Comment on Proposal 1-74.

Log # 3432

1- 79 - (Article 100-Transportable-(New)): Reject
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 12 and 17 for information.
SUBMITTER: George J. Foster, Western Reserve Division IAEI
RECOMMENDATION: Shift to Article 100, Definitions, Part A.
Transportable: X-ray equipment to be installed in a vehicle or that may be readily disassembled for transport in a vehicle.
SUBSTANTIATION: Identical definitions are found in Article 517, Section 517-140 and Article 660, Section 660-2. Scope of Article 100 permits consolidation of definitions when the terms are used in two or more articles. Consolidations of the definition meets requirements of NEC style and eliminates duplication of Code text.
PANEL ACTION: Reject.
PANEL COMMENT: This definition is suitable for Article 600, but it may not apply for all the contexts for which it may be used throughout the Code. Refer to CMP 12 and CMP 17 for information.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 858

1- 80 - (Article 100, Part B-Scope): Accept
Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change the last sentence of the scope to read as follows:
"Part B contains definitions applicable only to articles or parts of articles covering medium- and high-voltage installations and equipment."
SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium-, and high-voltage circuits, equipment and systems (Article 100 proposals). The definitions in Part B are not altered by this proposed change.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 7
NEGATIVE: Kitzantides, Summers.
EXPLANATION OF VOTE:
KITZANTIDES: See NEMA Comment on Proposal 1-82.
SUMMERS: Although the substantiation for this proposal indicates that the purpose of the Ad Hoc Subcommittee proposals was to obtain consistency with industry practices, it has gone far beyond the needs expressed by CMP 1. In addition, the establishment of the various voltage levels is totally inconsistent with current industry practice. Almost everyone visualizes Class 1, Class 2 and Class 3 circuits when talking about low voltage circuits. And when referring to high voltage circuits it is uniformly understood that the voltage is above 1000 volts. Acceptance of these proposals will require re-education of a whole generation of electricians, contractors and inspectors and the only benefit seems to be achieving uniformity between the NEC and other industry standards.

Log # 864

1- 85 - (Article 100, Part B-Title and Introduction): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change the title of Part B to read as follows:
"B. Medium and High Voltage"
Change the unlabeled paragraph directly under the title to Part B to read as follows:
"Whereas the definitions in Part A are intended to apply wherever the terms are used throughout the Code, the definitions in Part B are applicable only to medium- and high-voltage installations and equipment."
SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium-, and high-voltage circuits, equipment and systems (Article 100 proposals). The intent of the introductory paragraph to Part B is not altered by this proposal.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 7
NEGATIVE: Kitzantides, Summers.
EXPLANATION OF VOTE:
KITZANTIDES: See NEMA comment on Proposal 1-82.
SUMMERS: See comments on Proposal 1-80.

1- 81 - (Article 100, Extra-low Voltage Circuit, Equipment or System-(New)): Accept
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to all Panels for information.
SUBMITTER: CMP 1
RECOMMENDATION: Add a new definition.
An electrical circuit, equipment or system where the voltage does not exceed 30V RMS or 42.4 V dc.
SUBSTANTIATION: The use of "low-voltage" for 1000 V line-to-line and 600 V to ground as proposed by the NEC Correlating Committee Ad Hoc Subcommittee on Voltages leaves a void for the nonhazardous voltage levels for which in large segments of the electrical and electronic industry "low-voltage" is used. "Extra-low voltage" fills this void. The reduced voltage levels indicated for example in Section 110-16(a), Exception No. 2; Section 300-5(a), Exception No. 8; Section 551-2 ("Low-Voltage") reflect the intent of the proposed definition, although they are not consistent. Replacement of the various voltage levels with "extra-low voltage" removes the inconsistency. Article 725 also includes some nonhazardous voltage levels for Class 2 circuits. These should remain to indicate the voltages which are considered not to involve a risk of electric shock. "Extra-low voltage" is used in a similar context in the Canadian Electrical Code and some Standards of the International Electrotechnical Commission.
PANEL ACTION: Accept.
Add new definition to Part A, before existing definition for Voltage (of a circuit).
"Voltage: Extra-low voltage circuit, equipment or system".
PANEL COMMENT: Refer to CMP 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18 and 19.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 7
NEGATIVE: Hession, Kitzantides.
EXPLANATION OF VOTE:
HESSION: The present requirements for low voltage circuits as addressed in Article 725 have proved effective and safe over many years. Even with the large growth experienced by the electronic and telecommunication industries, these voltage levels have withstood the test of time and have not proven to be a hazard. Since the proponent recognizes these voltage levels for Class 2 circuits addressed in Article 725, as being safe by their supporting statement; "that these voltages should remain and are considered not to involve a risk of electrical shock", reduces the validity or need for this change.

The proposed new criteria for extra-low voltage circuits, 30 VRMS or 42.4 VDC, does not recognize or accommodate the nominal 48 VDC so widely used in the telecommunications industry. The proposal in fact would tend to muddy the waters rather than to achieve a greater degree of safety. The proponent could address the concerns of the telecommunications industry if the description were revised to include 60 VDC which is addressed in Article 725. The supportive statement offers nothing substantive to justify this change.

The proposal should have also been circulated to CMP-16 for their input.

KITZANTIDES: Proposal is not needed in view of NEMA's negative vote on the other proposals dealing with the voltage definitions. In addition, there is no substantiation that the selected voltage values properly address the risk of electric shock.

Log # 861

1- 84 - (Article 100-High-Voltage-(New)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add a new definition to Part A of Article 100 as follows:

HIGH-VOLTAGE CIRCUIT, EQUIPMENT OR SYSTEM

An ac or dc electrical circuit, equipment or system where the line-to-line voltage is equal to or greater than 100,000 volts, nominal, and is less than 230,000 volts, nominal.

(FPN) The term "HIGH VOLTAGE" as used on warning signs signifies a risk of electric shock, not a system or circuit voltage level.

SUBSTANTIATION: This proposal is a continuation of the proposal to add defined standard terms, to the Code that are in harmony with other standards and industry practices, standards such as ANSI C84.1-1982, Electric Power Systems and Equipment - Voltage Ratings (60 Hz.), ANSI/IEEE Standard 100-1984, IEEE Standard Dictionary of Electrical and Electronic Terms.

See proposal for Article 100, Definition of "Low-Voltage".

PANEL ACTION: Accept.

In Part A add the following after new definition of "Medium Voltage":

"High-Voltage Circuit, Equipment or System. See Part B Medium and High Voltage".

In Part B add new definition after new definition of "Medium Voltage":

"Medium-Voltage Circuit, Equipment or System".

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 862

1- 82 - (Article 100-Low-Voltage-(New)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add a new definition to Part A of Article 100 as follows:

LOW-VOLTAGE CIRCUIT, EQUIPMENT OR SYSTEM

An ac or dc electrical circuit, equipment or system where the voltage-to-ground does not exceed 600 volts, nominal, and the line-to-line voltage does not exceed 1000 volts, nominal.

SUBSTANTIATION: The Ad Hoc Subcommittee on Voltages, established by the National Electrical Code Correlating Committee, was given the assignment:

1. To review the limits of system voltages used in the 1987 NEC.

2. To study related ANSI standards and others for uses of terms describing system voltages which may differ from uses in the 1987 NEC.

3. To recommend changes in definition or terminology, if necessary, to accommodate recognized industry practices in the limits assigned to system voltages.

The Subcommittee is proposing three terms; low-voltage, medium-voltage, and high-voltage, to be used throughout the Code with a consistent meaning and defined limits.

The nominal line-to-line voltage dividing points between the voltage ranges associated with each of these three terms are those presently shown in ANSI C84.1-1982, the American National Standard for Electrical Power Systems and Equipment - Voltage Ratings (60 Hz.) In addition, the proposal that a low-voltage circuit or system must have a voltage-to-ground of 600 volts or less, nominal, is consistent with the implied definition of low voltage in the 1987 NEC. The 1000 volt, nominal, top limit on low-voltage ac circuits, equipment, and systems is also in harmony with IEC Standard Publication 449, Voltage Bands for Electrical Installations of Buildings; IEC 664, Insulation Coordination; and ANSI/IEEE Standard 100-1984, IEEE Standard Dictionary of Electrical and Electronic Terms.

The present Code uses the term "low-voltage" with different meanings in paragraphs 110-34(b), 364-30, 551-2 (p. 542), etc. The proposed definition fills a need for a term in common use by the electrical community and in harmony with all the related standards that could be identified.

The proposal establishes a 1000 volt, nominal, upper limit on line-to-line voltage for low-voltage applications. It is based on the maximum limit of 600 volts, nominal, to ground, which has been in the NEC for many years. This proposal is consistent with the primary shock and fire hazard (ground fault) consideration.

PANEL ACTION: Accept.

PANEL COMMENT: Add new definition to Part A after new definition of "Extra-low voltage"

"Low-voltage circuit, equipment or system".

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: The proposal would affect the ratings and change practices and provide the potential for misinterpretation and misapplications in the field. It has been developed solely for consistency, without consideration of the possible results of such changes.

Log # 863

1- 83 - (Article 100-Medium-Voltage-(New)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add a new definition to Part A of Article 100 as follows:

MEDIUM-VOLTAGE CIRCUIT, EQUIPMENT OR SYSTEM

An ac or dc electrical circuit, equipment or system where the voltage-to-ground exceeds 600 volts, nominal, or the line-to-line voltage exceeds 1000 volts, nominal, and is less than 100,000 volts, nominal.

SUBSTANTIATION: Same as Proposal 1-84.

PANEL ACTION: Accept.

In Part A add the following after new definition of "Low Voltage":

"Medium-Voltage Circuit, Equipment or System. See Part B Medium and High Voltage".

In Part B add new definition after "Switching devices":

"Voltage

Medium-Voltage Circuit, Equipment or System".

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

ARTICLE 110 -- REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

Log # 817

1- 86 - (110-1): Reject

SUBMITTER: William F. Daley, Hanover, MA

RECOMMENDATION: Revise second sentence as follows:

"Explanatory material and references to mandatory rules are in the form of fine print notes (FPN)."

SUBSTANTIATION: To alert users of the NEC to the mandatory references contained in many existing fine print notes.

PANEL ACTION: Reject.

PANEL COMMENT: There are no mandatory references in fine print notes.

VOTE ON PANEL ACTION: Unanimously Affirmative.

The proposed new criteria for extra-low voltage circuits, 30 VRMS or 42.4 VDC, does not recognize or accommodate the nominal 48 VDC so widely used in the telecommunications industry. The proposal in fact would tend to muddy the waters rather than to achieve a greater degree of safety. The proponent could address the concerns of the telecommunications industry if the description were revised to include 60 VDC which is addressed in Article 725. The supportive statement offers nothing substantive to justify this change.

The proposal should have also been circulated to CMP-16 for their input.

KITZANTIDES: Proposal is not needed in view of NEMA's negative vote on the other proposals dealing with the voltage definitions. In addition, there is no substantiation that the selected voltage values properly address the risk of electric shock.

Log # 861

1- 84 - (Article 100-High-Voltage-(New)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add a new definition to Part A of Article 100 as follows:

HIGH-VOLTAGE CIRCUIT, EQUIPMENT OR SYSTEM

An ac or dc electrical circuit, equipment or system where the line-to-line voltage is equal to or greater than 100,000 volts, nominal, and is less than 230,000 volts, nominal.

(FPN) The term "HIGH VOLTAGE" as used on warning signs signifies a risk of electric shock, not a system or circuit voltage level.

SUBSTANTIATION: This proposal is a continuation of the proposal to add defined standard terms, to the Code that are in harmony with other standards and industry practices, standards such as ANSI C84.1-1982, Electric Power Systems and Equipment - Voltage Ratings (60 Hz.), ANSI/IEEE Standard 100-1984, IEEE Standard Dictionary of Electrical and Electronic Terms.

See proposal for Article 100, Definition of "Low-Voltage".

PANEL ACTION: Accept.

In Part A add the following after new definition of "Medium Voltage":

"High-Voltage Circuit, Equipment or System. See Part B Medium and High Voltage".

In Part B add new definition after new definition of "Medium Voltage":

"Medium-Voltage Circuit, Equipment or System".

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 862

1- 82 - (Article 100-Low-Voltage-(New)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add a new definition to Part A of Article 100 as follows:

LOW-VOLTAGE CIRCUIT, EQUIPMENT OR SYSTEM

An ac or dc electrical circuit, equipment or system where the voltage-to-ground does not exceed 600 volts, nominal, and the line-to-line voltage does not exceed 1000 volts, nominal.

SUBSTANTIATION: The Ad Hoc Subcommittee on Voltages, established by the National Electrical Code Correlating Committee, was given the assignment:

1. To review the limits of system voltages used in the 1987 NEC.

2. To study related ANSI standards and others for uses of terms describing system voltages which may differ from uses in the 1987 NEC.

3. To recommend changes in definition or terminology, if necessary, to accommodate recognized industry practices in the limits assigned to system voltages.

The Subcommittee is proposing three terms; low-voltage, medium-voltage, and high-voltage, to be used throughout the Code with a consistent meaning and defined limits.

The nominal line-to-line voltage dividing points between the voltage ranges associated with each of these three terms are those presently shown in ANSI C84.1-1982, the American National Standard for Electrical Power Systems and Equipment - Voltage Ratings (60 Hz.) In addition, the proposal that a low-voltage circuit or system must have a voltage-to-ground of 600 volts or less, nominal, is consistent with the implied definition of low voltage in the 1987 NEC. The 1000 volt, nominal, top limit on low-voltage ac circuits, equipment, and systems is also in harmony with IEC Standard Publication 449, Voltage Bands for Electrical Installations of Buildings; IEC 664, Insulation Coordination; and ANSI/IEEE Standard 100-1984, IEEE Standard Dictionary of Electrical and Electronic Terms.

The present Code uses the term "low-voltage" with different meanings in paragraphs 110-34(b), 364-30, 551-2 (p. 542), etc. The proposed definition fills a need for a term in common use by the electrical community and in harmony with all the related standards that could be identified.

The proposal establishes a 1000 volt, nominal, upper limit on line-to-line voltage for low-voltage applications. It is based on the maximum limit of 600 volts, nominal, to ground, which has been in the NEC for many years. This proposal is consistent with the primary shock and fire hazard (ground fault) consideration.

PANEL ACTION: Accept.

PANEL COMMENT: Add new definition to Part A after new definition of "Extra-low voltage"

"Low-voltage circuit, equipment or system".

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: The proposal would affect the ratings and change practices and provide the potential for misinterpretation and misapplications in the field. It has been developed solely for consistency, without consideration of the possible results of such changes.

Log # 863

1- 83 - (Article 100-Medium-Voltage-(New)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add a new definition to Part A of Article 100 as follows:

MEDIUM-VOLTAGE CIRCUIT, EQUIPMENT OR SYSTEM

An ac or dc electrical circuit, equipment or system where the voltage-to-ground exceeds 600 volts, nominal, or the line-to-line voltage exceeds 1000 volts, nominal, and is less than 100,000 volts, nominal.

SUBSTANTIATION: Same as Proposal 1-84.

PANEL ACTION: Accept.

In Part A add the following after new definition of "Low Voltage":

"Medium-Voltage Circuit, Equipment or System. See Part B Medium and High Voltage".

In Part B add new definition after "Switching devices":

"Voltage

Medium-Voltage Circuit, Equipment or System".

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

ARTICLE 110 -- REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

Log # 817

1- 86 - (110-1): Reject

SUBMITTER: William F. Daley, Hanover, MA

RECOMMENDATION: Revise second sentence as follows:

"Explanatory material and references to mandatory rules are in the form of fine print notes (FPN)."

SUBSTANTIATION: To alert users of the NEC to the mandatory references contained in many existing fine print notes.

PANEL ACTION: Reject.

PANEL COMMENT: There are no mandatory references in fine print notes.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1697

1- 87 - (110-2): Reject

SUBMITTER: Jerome M. Frank, Jerome M. Frank and Associates

RECOMMENDATION: Add:

"Where approved equipment is available, use of approved equipment shall be mandatory."

SUBSTANTIATION: From external appearances of equipment, authorities having jurisdiction have no way of determining the safety or fire hazard of the device being installed. Internal arcs in windings can produce dangerous and hazardous temperatures and can create serious fires if the insulation system has not been tested and is not self extinguishing once the source of heat has been removed. Unlisted medium voltage transformer, some using insulation systems, that have not been U.L. tested and UL component recognized, (i.e. cast coil transformers), are being installed as dry type transformers in buildings without fire proof vaults. U.L. listed and approved medium voltage transformer using UL component recognized 220°C insulation systems, are available per U.L. 1562. These are the only dry type transformers that should be installed indoors without a fire proof vault.

PANEL ACTION: Reject.

PANEL COMMENT: This proposal is neither consistent with the definitions in Article 100 nor within the purview of CMP 1 to grant.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1198

1- 88 - (110-4): Accept in Principle

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: New wording to be added in the end of article 110-4:

"(The following ranges of nominal voltage (r.m.s values for a.c) are defined:

EXTRA LOW VOLTAGE: normally not exceeding 50 volts a.c or 50 volts d.c whether between conductors or to ground.

LOW VOLTAGE: normally exceeding extra low voltage but not exceeding 1000 volts a.c or 1500 volts d.c between conductors, or 600 volts a.c or 900 volts d.c between any conductor and ground.

MEDIUM VOLTAGE: normally exceeding low voltage but not exceeding 45 k volts.

HIGH VOLTAGE: normally over 45 k volts.)"

SUBSTANTIATION: The NEC CODE gave separately some limits of voltage ranges: (720-1) (220-2) (710-1) (table 710-3b) (110-34b) (326-1) (326-3), some intervals rest without definition or limits. There are great distinctions between voltage ranges (f.e) in the following situations:

System of distribution, grounding, security, warning, safety, insulation application, perturbations, sensitive precaution, danger, qualification of personnel, manufacturing, maintenance personnel . . .

Therefore it is essential to summarize the definition of voltage ranges in the article 110-4.

In the future that could permit the adoption and the limitation of the Standardized values in every range, particularly for the Low and Middle voltage.

Standardized values is a National necessity for the future and for new installations.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Comment on Proposals 1-81, 1-82, 1-83 and 1-84. These levels are not consistent with ANSI C84.1 or the IEC.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

Log # 1199

1- 89 - (110-4): Accept in Principle

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: New wording to be added in the end of article 110-4:

"(The following ranges of nominal voltage (r.m.s values for a.c) are defined:

EXTRA LOW VOLTAGE: normally not exceeding 50 volts a.c or 50 volts d.c whether between conductors or to ground.

LOW VOLTAGE: normally exceeding extra low voltage but not exceeding 600 volts a.c or 1000 volts d.c between conductors, or 360 volts a.c or 600 volts d.c between any conductor and ground.

MEDIUM VOLTAGE: normally exceeding low voltage but not exceeding 35 k volts.

HIGH VOLTAGE: normally over 35 k volts.)"

SUBSTANTIATION: This proposal does not consider the range of insulation, but it conforms with the articles of the NEC CODE (720-1), (220-2), (710-1), (table 710-3b), (110-34b), (326-3).

Proposal 1- (Log #1198).

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Comment on Proposal 1-88.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

Log # 1200

1- 90 - (110-6 and Chapter 9, Table 10-(New)): Reject

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: Text should be added in the end of the article 110-6:

"(For metric conversion of size of conductors, to the International System of Units (S.I), see table of conversion in Chapter 9 - table No 10.)"

- To include proposed table No 10 in chapter 9. (Table No. 10 shown on following page.)

SUBSTANTIATION: To facilitate the extension of culture and Science throughout the world, the competition of products, the better use of the NEC CODE, and to conform with the Article 90-8.

The proposed wording is to add, as a minimum, table of conversion for the size of conductors between (AWG) and (S.I).

- Enclosed the proposed table No 10.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-16.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2354

1- 91 - (110-7): Reject

SUBMITTER: Myron N. Daniels, U.S. Navy Ship Yard Pearl Harbor, HI

RECOMMENDATION: Add sentence:

The integrity of the insulation shall be demonstrated by the use of a non-destructive test instrument suitable for the conditions, applied to the wiring & wiring system.

SUBSTANTIATION: Article 110-7 as written has no enforcement direction or criteria. As a consequence, the wiring is never assured to be in compliance with the intent of Art. 110-7.

The most common compliance is when the wiring installer energizes the wiring by putting on the power. If the overcurrent device does not trip, it is ASSUMED the wiring is in compliance with Art 110-7. This is nonsense. There could be a short circuit of low enough magnitude that could injure a person by electric shock or start a fire. Such was a case I investigated where a little girl sustained a non-fatal shock when she touched a curtain rod over a sink, where new wiring had been installed.

My understanding of Art 90-1 must be different from these who are only interested in expedience & the dollars saved by not properly testing the wiring, wiring systems.

PANEL ACTION: Reject.

PANEL COMMENT: The 1965 NEC had a table for insulation resistances that was removed because such recommendations are not enforceable and the measurements are not ordinarily followed. Ideal measurements are variable depending on conditions such as humidity, and interpretation of results are required; therefore tabular results are not always ideal. The same rationale applies today.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Table of conversion for the size of conductors between
American Wiring Gauge (AWG) and the International System of Units (SI).

Gauge number	Area C.M	Diameter* mil	Area in ²	Diameter* in	Area mm ²	Diameter* mm	(S.I) Area mm ²	Gauge number
Size AWG								
20	1 022	31.9687	0.000802	0.03196	0.518	0.812	0.50	20
19	1 288	35.8887	0.001012	0.03589	0.652	0.911	—	19
18	1 620	40.2492	0.001276	0.04030	0.821	1.022	0.75	18
17	2 048	45.2548	0.001609	0.04526	1.037	1.149	1.00	17
16	2 580	50.7937	0.002028	0.05082	1.307	1.290	—	16
15	3 257	57.0701	0.002558	0.05707	1.650	1.449	1.5	15
14	4 110	64.1093	0.003225	0.06408	2.082	1.628	—	14
13	5 178	71.9583	0.004067	0.07196	2.623	1.827	2.5	13
12	6 530	80.8084	0.005129	0.08081	3.308	2.052	—	12
11	8 234	90.7414	0.006467	0.09074	4.171	2.304	4	11
10	10 380	101.8823	0.008155	0.10190	5.258	2.587	—	10
9	13 090	114.4115	0.010280	0.11440	6.630	2.905	6	9
8	16 510	128.4912	0.012970	0.12850	8.362	3.262	—	8
7	20 820	144.2914	0.016350	0.14430	10.545	3.664	10	7
6	26 240	161.9877	0.020620	0.16200	13.291	4.113	—	6
5	33 100	181.9340	0.026000	0.18190	16.765	4.619	16	5
4	41 740	204.3037	0.032780	0.20430	21.141	5.187	—	4
3	52 620	229.3905	0.041340	0.22940	26.652	5.824	25	3
2	66 360	257.6043	0.052130	0.25760	33.611	6.541	35	2
1	83 690	289.2922	0.065730	0.28930	42.389	7.345	—	1
1/0	105 600	324.9615	0.082890	0.32490	53.486	8.251	50	1/0
2/0	133 100	364.8287	0.104500	0.36480	67.415	9.263	70	2/0
3/0	167 800	409.6340	0.131800	0.40960	84.991	10.401	—	3/0
4/0	211 600	460.0000	0.166200	0.46000	107.175	11.679	95	4/0
Size MCM								
250	250 000	500.0000	0.196257	0.49978	126.625	12.695	120	250
300	300 000	547.7226	0.235500	0.54747	151.950	13.907	150	300
350	350 000	591.6080	0.275800	0.59536	177.275	15.021	185	350
400	400 000	632.4555	0.312000	0.63015	202.600	16.058	—	400
500	500 000	707.1068	0.392503	0.70679	253.250	17.953	240	500
600	600 000	774.5967	0.471018	0.77426	303.900	19.667	300	600
700	700 000	836.6660	0.549521	0.83629	354.550	21.243	—	700
750	750 000	866.0254	0.588772	0.86565	379.875	21.988	—	750
800	800 000	894.4292	0.628024	0.89404	405.200	22.709	400	800
900	900 000	948.6833	0.706526	0.94827	455.850	24.087	450	900
1000	1000 000	1000.0000	0.785029	0.99956	506.500	25.390	500	1000
1250	1250 000	1118.0339	0.981287	1.11754	633.125	28.387	630	1250
1500	1500 000	1224.7448	1.177544	1.22421	759.750	31.096	—	1500
1750	1750 000	1322.8756	1.373800	1.32230	886.375	33.587	800	1750
2000	2000 000	1414.2135	1.570059	1.41359	1013.000	35.906	1000	2000

*As solid conductors ie Single core.

D Diameter

A Area of cross section

D diameter (mil) = 0.001 of an inch.

A Circular mil (C.M) = (mil)²

MCM = Thousands of C.M

A (in²) = $\frac{\pi}{4}$ D in²

A (C.M) = D mil²

				Cross Section			
Diameter				mm ²	in ²	C.M	MCM
mm	in	mil					
1	0.03937	39.37		1	0.00155	1974.3	1.9743
25.3997	1	1000		645.162	1	1.2738 10 ⁶	1273.8
0.02539	0.001	1		506.5 10 ⁻⁶	0.785 10 ⁻⁶	1	0.001
				0.5065	0.785 10 ⁻³	1000	1

Submitted material has been reproduced as received.
See note on Page 1.

Log # 1731

1- 92 - (110-9, FPN-(New)): Reject

SUBMITTER: George D. Gregory, Square D Company

RECOMMENDATION: Add:

(FPN): The interrupting rating referred to above may include the series combination of an upstream overcurrent protective device in series with a downstream circuit breaker, the downstream breaker having an interrupting rating less than that of the combination and used in labeled equipment marked to identify the series combination.

SUBSTANTIATION: UL 489 and UL 67 have included test requirements for series combinations for a number of years, and series combinations have been applied for a number of years. This fine print note is intended to inform Code users of the acceptability of these ratings. It also informs users that a tested rating is marked on equipment containing the downstream circuit breaker.

PANEL ACTION: Reject.

PANEL COMMENT: This is common practice in the industry and is not needed for clarity in the NEC.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: NEMA agrees with the Substantiation. The f.p.n. should be added for the purpose of clarity.

Log # 67

1- 93 - (110-10): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line as indicated:

... total impedance, the component"/equipment" short circuit ...

SUBSTANTIATION: In the interest of safety, this proposal should be approved because the term "component" is simply not associated with switchboard, panelboards and related equipment by many code users.

PANEL ACTION: Reject.

PANEL COMMENT: The term "component" includes equipment.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1570

1- 94 - (110-12(a)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in the sentence as indicated:

... protection substantially equivalent to the (wall of the equipment.) "material of the enclosure."

SUBSTANTIATION: This change will more adequately express the meaning/intent of the Code. For example, see Equipment definition on page 70-9; the term equipment includes material, fittings, devices, appliances, fixtures, apparatus. The use of the term "wall of the equipment" in reference to the above "equipment" is lacking in clarity and consistency.

PANEL ACTION: Reject.

PANEL COMMENT: The existing language is clearer than the proposed revision.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1337

1- 95 - (110-12(c)-(New)): Reject

SUBMITTER: Pete Rinckhoff, City of Portland

RECOMMENDATION: Add new subsection C:

All abandoned wiring shall be removed.

SUBSTANTIATION: It has been my experience that wiring that has been supposedly disconnected and abandoned was found to be still energized. It is my intention that all abandoned wiring should be removed from the premise's wiring system completely. I feel that this can be a hazard to life and property.

PANEL ACTION: Reject.

PANEL COMMENT: Such a Code provision would be unenforceable.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2395

1- 96 - (110-12(c)-(New)): Reject

SUBMITTER: Glenn W. Zieseniss, Crown Point, IN

RECOMMENDATION: Add new subsection (c)

(c) Name Plate Data. Name plate data attached to equipment shall not be concealed by field mounted electrical apparatus.

SUBSTANTIATION: Field mounted disconnect switches etc. mounted over name plate data, such as air conditioner name plate data hinders the serviceman from determining volts, amps, refrigerant etc.

PANEL ACTION: Reject.

PANEL COMMENT: The marking requirements of Section 110-21 anticipate that the marking will be readable after installation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1096

1- 97 - (110-14): Accept in Part

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in the first sentence as indicated:

... shall be (suitable) "identified" for the ...

Amend the fifth line in the second sentence as indicated:

... device is (suitable) "identified" for the ...

Amend the second line in the third sentence as indicated:

... shall be (suitable) "identified" for the ...

SUBSTANTIATION: Same as Proposal 1-76.

PANEL ACTION: Accept in Part.

PANEL COMMENT: The term "suitable" in the 2nd line, third sentence is appropriate.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2682

1- 98 - (110-14, FPN): Reject

SUBMITTER: Joseph Harackiewicz, Boston, MA

RECOMMENDATION: Revised text:

(FPN): Many terminations and equipment are marked with a tightening torque, and shall be so torqued within tolerances of 10% of their markings

SUBSTANTIATION: Loose connections have been attributed to arcing and fires, as well as improperly torqued connections over torque or under torque.

Most screw lugs and terminals can withstand 10% over torque without problems.

NEC 430-9 has mandated minimum torque values thus requiring contractors and mechanics to have proper installation and maintenance tools.

PANEL ACTION: Reject.

PANEL COMMENT: In accordance with Section 110-1, fine print notes cannot contain mandatory requirements.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3269

1- 99 - (110-14, FPN-(New)): Reject

SUBMITTER: Gilbert L. Thompson, Baltimore County Electrical Inspection Division

RECOMMENDATION: Add an additional FPN to Section 110-14 to read as follows:

Except as noted on the product or termination provision electrical testing laboratories call for the use of copper conductors and are based on ampacities found in Table 310-16 for the use of 60C insulated conductors in circuits rated 100 amperes or less and the use of 75C insulated conductors in higher rated circuits - See 110-3.

SUBSTANTIATION: To help reduce the heat that is generated when the wrong type, kind and temperature rated conductor is terminated. These provisions have been in the listing guides of most accepted and qualified testing labs for a number of years. Unless the installer has a copy or is familiar with the provisions, then they invariably try to use the ampacity of a different kind or type conductor with a higher temperature rating, not realizing the problem or stress they are creating on the terminal itself.

Special equipment or terminations that have been tested to receive aluminum wire or ones that can withstand a higher temperature are already properly identified to the trade. This new FPN should not cause manufacturers to change any of their labeling procedures.

PANEL ACTION: Reject.

PANEL COMMENT: The information provided is not correct for all equipment. See Section 110-3(b).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1097

1- 100 - (110-14(b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third and fourth lines in the third sentence as indicated:

... insulating device (suitable) "identified" for the ...

SUBSTANTIATION: The use of the term "suitable" can/does result in an infinite variety of different Code interpretations/actions being used/applied in ways that could cause ineffective, undesirable or disastrous results. It is, therefore, strongly recommended that, in the interest of Code-required levels of safety, compliance and uniformity, the term "identified" (which is defined in Article 100/FPN on Page 10) be used because it more adequately defines the requirements needed to ensure the establishment/maintenance of Code-mandated/sanctioned standards that are essential in the safeguarding of persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: Current wording is adequate. All suitable devices may not be identified.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2173

1- 101 - (110-14(c)-(New)): Reject

SUBMITTER: Carmen Moss Hodnett, Aluminum Association

RECOMMENDATION: New text:

(c) Where bolted or screw-type terminations are made on either copper or aluminum alloy conductors, all bolts and screws shall be torqued to the torque setting specified by the manufacturer.

SUBSTANTIATION: The proper use of a torque wrench is critical to all electrical connections and terminations. However, the actual usage of the tool is practically non-existent in the field. And until the requirements for proper torquing is made in the NEC, countless and unnecessary electrical system failures will continue. Because torque values are included within the package for the devices, the values are readily accessible to the purchaser and installer. To include the New Section 110-14(c) is consistent with 110-3b of the '87 NEC.

PANEL ACTION: Reject.

PANEL COMMENT: Current provisions of Sections 110-14(c) and 110-3(b) adequately cover this subject.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2363

1- 102 - (110-14(c)-(New)): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: New text:

Electrical connections, splices or terminations which are exposed to elements shall be made waterproof, using approved methods and with identified materials.

SUBSTANTIATION: Splices, terminations and connections made in hand holes or brooks boxes cannot simply be made with electric tape, especially when these boxes often retain the water for several days. These terminations should be made using approved methods.

PANEL ACTION: Reject.

PANEL COMMENT: This requirement is unnecessary in many instances; for instance, uninsulated conductor, triplex service-drop terminations, bonding connections, etc.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 865

1- 103 - (110-16, Heading): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise heading to read:

110-16. Working Space About Low-Voltage Electric Equipment.

SUBSTANTIATION: The proposal is to obtain consistency in voltage terminology throughout the Code and to incorporate recognized industry standards and practices. See proposed definitions of low-, medium- and high-voltage circuits, equipment and systems (Article 100 proposals). The intent of this section is not altered by the proposed change because the requirements in it are based on voltages to ground and the proposed definition of "low-voltage" encompasses the same voltage level to ground as presently indicated in this Section.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 2911

1- 104 - (110-16): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to 110-16:

"Space shall be maintained in front of switchgear to allow breakers, etc., to be removed and turned without obstruction.

SUBSTANTIATION: Designers configure switchgear rooms, etc, without consideration for the maintenance requirements of specific tests, such as high current circuit breaker tests, that require access to all parts of the breaker.

PANEL ACTION: Reject.

PANEL COMMENT: It is the opinion of CMP 1 that the work space requirements of Section 110-16 already provides sufficient work space.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 818

1- 105 - (110-16(a)): Reject

SUBMITTER: Joseph L. Giovanello, Brockton, MA

RECOMMENDATION: Revise second sentence of paragraph two as follows:

"In all cases the work space shall permit at least a 90-degree opening of equipment doors or hinged panels, except where they can be removed."

SUBSTANTIATION: This may be a more reasonable approach to this condition which is permitted in Section 610-57 for controls at cranes and hoists.

PANEL ACTION: Reject.

PANEL COMMENT: Section 90-3 permits the general rules to be modified in Article 610, but in other instances CMP 1 feels the additional space is necessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 866

1- 106 - (110-16(a)): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise third line of Section 110-16(a) to read:

... live parts operating at 600 volts, nominal, or less to ground and likely to require ...

SUBSTANTIATION: The added "to ground" defines voltage measurement points and correlates with Table 110-16(a).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

Log # 2229

1- 107 - (110-16(a)): Reject

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: In the second paragraph, add the following words to the first sentence:
"to the floor or platform".

SUBSTANTIATION: It is to clarify that the 30-inch dimension is to be clear to the floor or platform in front of the electric equipment.

PANEL ACTION: Reject.

PANEL COMMENT: It is the intent of Section 110-16(a) that clear space in Table 110-16(a) means unimpeded space.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2913

1- 108 - (110-16(a)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add a new paragraph to 110-16(a)

"Permanently mounted devices, panelboards, etc located on the walls shall not encroach on the space requirements of Table 110-16(a)."

SUBSTANTIATION: Contractors are installing equipment on walls by switchgear thereby defeating intent of Code for a clear and unobstructed work space.

PANEL ACTION: Reject.

PANEL COMMENT: It is the opinion of CMP 1 that Section 110-16 already requires such clear work spaces.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2914

1- 109 - (110-16(a)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to paragraph 110-16(a)

"Where columns extend into the room beyond the wall surface, the face of the column shall not encroach on the space requirements of Table 110-16(a)"

SUBSTANTIATION: Designers configure areas for switchgear without consideration for the obstructions caused by projecting columns.

PANEL ACTION: Reject.

PANEL COMMENT: It is the opinion of CMP 1 that Section 110-16 already requires such clear workspaces.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3442

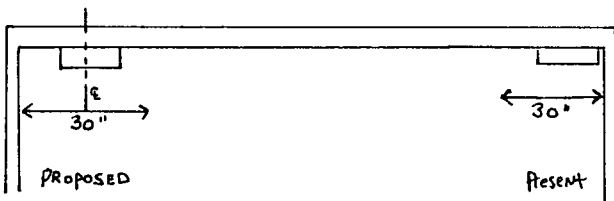
1- 110 - (110-16(a)): Reject

SUBMITTER: Robert F. Seel, City of Allentown, PA

RECOMMENDATION: Add a sentence after . . . 30 inches (762 mm) wide in front of the electric equipment.
"This dimension shall be centered on the equipment."

NOTE: Added material in quotations.

SUBSTANTIATION: This additional sentence will provide proper working space in front of the equipment. Many installations have the equipment fastened directly against an adjacent wall. This results in a hazardous condition in that the energized equipment has only several inches to the grounded (adjacent) wall.



PANEL ACTION: Reject.

PANEL COMMENT: CMP 1 never intended to prohibit the application of the 30 inches from the edge of the equipment where necessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 867

1- 113 - (Table 110-16(a), Condition 1): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise last sentence to read:

"Insulated wire or insulated bus bars operating at 300 volts nominal, or less to ground shall not be considered live parts."

SUBSTANTIATION: To define voltage measurement point. The hazard involved is with respect to ground. Present text permits insulated wire or insulated bus bars operating at 300 volts to ground not to be considered as live parts for determining needed working space.

PANEL ACTION: Accept in Principle.

Change "live" to "energized".

PANEL COMMENT: To be consistent with NEC Style Manual.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Summers.

EXPLANATION OF VOTE:

SUMMERS: See comments on Proposal 1-80.

Log # 3142

1- 114 - (Table 110-16(a), Condition 1): Reject

SUBMITTER: William M. Swanson, Jr., Newton, MA

RECOMMENDATION: Delete the word "wood".

SUBSTANTIATION: Plumbing contractor on Dorchester Avenue, Boston - killed while moving wires with 2x4 wood stick.

PANEL ACTION: Reject.

PANEL COMMENT: Wood is a suitable material for use as a barrier.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 68

1- 111 - (110-16(a), Exception No. 2): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the last two lines in the exception as indicated:

. . . accessibility, or (2) where all uninsulated parts are at a voltage (no greater than) "not exceeding" 30 volts RMS or 42 V dc.

SUBSTANTIATION: This proposal should be adopted because it provides needed clarity and meaningful compliance with the NFPA Style Manual 1984, Part C-C-2a.

PANEL ACTION: Reject.

PANEL COMMENT: CMP 1 believes the language is sufficiently clear to obtain meaningful compliance.

The language is not in conflict with the Style Manual.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 230

1- 112 - (110-16(a), Exception No. 2): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Delete Exception No. 2 entirely.

SUBSTANTIATION: It is imperative that this change be approved for safety reasons because: (1) the wording used in the subject exception promotes a false sense of security with regards to uninsulated parts not over 30 volts RMS or 42V dc by permitting the clearances shown in Table 110-16(a) to be reduced; (2) there is no absolutely safe ac or dc voltage value in/around high ampacity electrical equipment where a short-circuit is possible; and (3) a code-allowed decrease in the working clearances required by Section 110-16(a) and indicated in Table 110-16(a) is an open invitation to disaster.

PANEL ACTION: Reject.

PANEL COMMENT: The proposer has not substantiated any problems with the exception.

VOTE ON PANEL ACTION: Unanimously Affirmative.

1- 115 - (110-16(c)): Reject

SUBMITTER: Del St. Laurent, Pacific Coast Electrical Association, Inc.

RECOMMENDATION: Revise as follows:

110-16(c) WORKING SPACE, ENTRANCE/EXIT"

At least one entrance/exit" of sufficient area shall be provided to give access to/from" the working space about electric equipment.

For switchboards and control panels rated 1200 amperes or more and over 6 feet (1.83m) wide, there shall be one entrance/exit" not less than "36 inches" (915mm) wide and 6' "8" (2.03m) high at each end.

EXCEPTION No. 1: Where the switchboards and panelboards location permits a continuous and unobstructed way of exit travel.

EXCEPTION No. 2: Where the work space required by Section 110-16(a) is doubled, only one entrance/exit" to/from" the working space is required.

Working space with one entrance/exit" provided shall be so located that the edge of the entrance/exit" nearest the switchboards and panelboards is the minimum clear distance given in Table 110-16(a) away from such equipment.

Note: Added or revised material in quotations.

SUBSTANTIATION: There has been confusion about the requirement for two doors in sections 110-16 and 110-33. Worse than that, 24" doors have actually been installed in equipment rooms. The intent of this proposal is to emphasize that access is intended to provide both entrance and exit ways, which by current national standards are required to be 36" minimum.

Also, this proposal would increase the safety factor in all electrical rooms by increasing the minimum door size from 24" to 36", facilitate installations, and make it easier for Code enforcement persons to interpret. Especially in high voltage rooms it is imperative that we have as much room as possible, not only to work, but in which to escape in the event of catastrophic failure. In case of an accident, because of the hazards involved, these rooms should be considered dangerous working areas and treated as such.

PANEL ACTION: Reject.

PANEL COMMENT: The standard for uniform dimensions of doorways evolved from life safety standards pertaining to means of egress.

Although the dimensions are represented as a national standard, it is far from uniform as all model codes permit smaller dimensions in certain occupancies and locations.

It was never the intent of CMP 1 to mandate compliance with means of egress requirements for the size of the doorway, panic hardware, nor swing of the door.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Summers.

EXPLANATION OF VOTE:

SUMMERS: See comments on Proposal 1-119.

1- 116 - (110-16(c)): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 9 for information.

SUBMITTER: CMP 1

RECOMMENDATION: In second paragraph of Section 110-16(c) change "switchboards and control panels" to "equipment containing overcurrent devices, switching devices, or control devices".

In Exception No. 1 delete "switchboards and panelboards".

In Exception No. 2, 2nd paragraph delete "switchboards and panelboards" and replace with "equipment".

SUBSTANTIATION: CMP 1 recognizes the nonuniform use of terms in 110-16(c) and this proposal resolves such inconsistencies.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: This change calls for the rating of the devices, rather than the rating of the equipment.

COMMENT ON VOTE:

SEELBACH: I believe the Recommendation should also state that the last sentence of present 110-16(c) is intended to be a part of Exception No. 2 and should be in the same type as the first sentence of Exception No. 2.

1- 117 - (110-16(c)): Accept in Principle

SUBMITTER: Brandon Burke, City of Palo Alto, CA

RECOMMENDATION: Revise as follows:

For switchboards, "panelboards" and control panels rated 1200 amperes or more and over 6 feet (1.83 m) wide, there shall be one entrance not less than 24 inches (610 mm) wide and 6 1/2 feet (1.98 m) high at each end.

Note: Added material in quotations.

SUBSTANTIATION: Addition of PANELBOARDS - to maintain consistency within section and avoid exemption of panelboards from the access requirement of this section.

Exception No. 1. And Paragraph #3 of this section makes reference to: "... Switchboards and panelboards."

The reference in Paragraph #2 to control panels and not panelboards has led to confusion.

The inclusion of PANELBOARDS to Paragraph #2 would prevent misinterpretation that this section may apply exclusively to switchboards and control panels (i.e. motor control panels).

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Panel 1 recognizes the inconsistency and omissions regarding these terms. See Panel Proposal 1-116.

VOTE ON PANEL ACTION: Unanimously Affirmative.

1- 118 - (110-16(c)): Reject

SUBMITTER: Steve Draheim, Three Bridges, NJ

RECOMMENDATION: Revise to read:

"At least one entrance, that opens out, of sufficient area"

SUBSTANTIATION: The Code should address the swing of required exit doors and where seconds count the door should swing out i.e. the direction of travel.

PANEL ACTION: Reject.

PANEL COMMENT: Opening the door outward may create greater hazards in some instances.

VOTE ON PANEL ACTION: Unanimously Affirmative.

1- 119 - (110-16(c)): Reject

SUBMITTER: M.E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (Log #2559)

Robert M. Milatovich, Southwestern Section International Association of Electrical Inspectors (Log #2702)

RECOMMENDATION: Revised text:

110-16 (c) WORKING SPACE, ENTRANCE/EXIT

At least one "entrance/exit" of sufficient area shall be provided to give access "to/from" the working space about electric equipment. For switchboards and control panels rated 1200 amperes or more and over 6 feet (1.83m) wide, there shall be one "entrance/exit" not less than "36 inches (915 mm)" wide and "6'8" high at each end.

EXCEPTION #1: Where the switchboards and panelboards location permits a continuous and unobstructed way of exit travel.

EXCEPTION #2: Where the work space required by Section 110-16 (a) is doubled, only one "entrance/exit to/from" the working space is required.

Working space with one "entrance/exit" provided shall be so located that the edge of the "entrance/exit" nearest the switchboards and panelboards is the minimum clear distance given in Table 110-16(a) away from such equipment.

Note: Revised material in quotations.

SUBSTANTIATION: There has been confusion about the requirements for two doors in sections 110-16 and 110-33. Worse than that, 24" doors have actually been installed in equipment rooms. The intent of this proposal is to emphasize that access is intended to provide both entrance and exit ways, which by current national standards are required to be 36" minimum.

Also, this proposal would increase the safety factor in all electrical rooms by increasing the minimum door size from 24" to 36", facilitate installations, and make it easier for Code enforcement persons to interpret. Especially in high voltage rooms it is imperative that we have as much room as possible, not only to work, but in which to escape in the event of catastrophic failure. In case of an accident, because of the hazards involved, these rooms should be considered dangerous working areas and treated as such.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-115.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Summers.

EXPLANATION OF VOTE:

SUMMERS: It is the IAEI position that confusion exists pertaining to the requirements for two doors and increased safety factors resulting from larger doorways would be easier for Code enforcement persons to interpret.

Log # 2710

1- 120 - (110-16(c) and 110-33(a)): Reject

SUBMITTER: Robert M. Milatovich, City of Fresno, CA

RECOMMENDATION: Add the following to the first paragraph:

"The entrance/exit door for the work space shall swing in the direction of exit travel and shall be openable from the inside without the use of a key or any special knowledge or effort."

SUBSTANTIATION: When a problem exists in a work space such as a fire or explosion you need to exit the area as soon as possible. If the exit door swings inside of the area you must first pull the door into the area to exit, if the swing is to the outside, you can exit out of the area without any hesitation. Being that safety is our prime concern this proposal is needed for all work spaces which have electrical equipment.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-118.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2782

1- 121 - (110-16(c)): Reject

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Revise Section 110-16(c) 3rd paragraph last line so it would read:

... clear distance "based upon the conditions 1, 2, or 3" as given in Table 110-16(a) ...

Note: Added material in quotations.

SUBSTANTIATION: As presently worded, it is not clear if the minimum of 3 feet applies in all instances or if the additional dimensions of conditions 2 or 3 for 151-600 voltages must be considered.

PANEL ACTION: Reject.

PANEL COMMENT: The application of Section 110-16(a) dictates the use of the 3 "conditions" in order to apply the dimensions of the table.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2912

1- 122 - (110-16(c)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add new paragraph to 110-16(c):

"Enclosed switchgear rooms shall have at least two means of egress, one at each extreme of the area, not necessarily in opposite walls. Doors shall swing out and be equipped with panic bars, pressure plates or other devices that are normally latched but open under simple pressure.

Exception: One door may be used when required by physical limitations if means are provided for unhampered exit during emergencies.

SUBSTANTIATION: Doors with conventional twist knobs are located in unusual areas, such as at the rear of the switchgear room, that are difficult to access and open in emergencies.

PANEL ACTION: Reject.

PANEL COMMENT: The access and entrance to working spaces is already adequately covered in 110-16(c). It is not intended that these doors meet the same requirements as other life safety standards for means of egress due to the limited access to the general public.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2490

1- 123 - (110-16(d)): Reject

SUBMITTER: James A. Boice, Wyoming, MI

RECOMMENDATION: Deleted Text.

(d) Front Working Space. In all cases where there are live parts normally exposed on the front of switchboards or motor control centers, the working space in front of such equipment shall not be less than "3 feet" (914 mm)

SUBSTANTIATION: In Table 110-16(a) Working Clearances. You already have your Minimum Clear Distance "3 feet". So there for 110-16(d) is a Repeat.

PANEL ACTION: Reject.

PANEL COMMENT: The material in Section 110-16(d) is not repeated material from Section 110-16(a) as the working clearances of Section 110-16(a) are required for all types of electrical equipment likely to require examination adjustment, servicing, or maintenance while energized; whereas, Section 110-16(d) is intended to apply to equipment whether or not it is likely to be serviced while energized.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2779

1- 124 - (110-16(e)): Reject

SUBMITTER: John J. Mooney, Belmont, MA

RECOMMENDATION: Add: "and outdoors" at end of sentence to read:

Illumination shall be provided for all working spaces about service equipment, switchboards, panelboards, or motor control centers installed indoors "and outdoors".

Note: Added material in quotations.

SUBSTANTIATION: EXAMPLE: Working on service equipment and panelboards in a 3' x 4' x 4' box located at a softball field for controlling lights and P.A. system, also a scoreboard.

PANEL ACTION: Reject.

PANEL COMMENT: Panel believes there is normally sufficient illumination outdoors except during night time hours. In such cases when needed, adequate illumination can be provided with a portable source.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2228

1- 125 - (110-16(e), Exception): Reject

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: Delete the Exception.

SUBSTANTIATION: Illumination is also needed in the Service equipment areas of dwelling units where home owners attempt resetting or replacement of overcurrent devices

PANEL ACTION: Reject.

PANEL COMMENT: Code mandated illumination is usually not necessary in residences and could be interpreted as requiring additional lighting from that already servicing the space.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2466

1- 126 - (110-16(f)): Reject
SUBMITTER: Fred Syswerda, Wyoming, MI
RECOMMENDATION: Change minimum headroom to 6 1/2 feet
SUBSTANTIATION: To match 110-32
PANEL ACTION: Reject.
PANEL COMMENT: The desire to obtain uniformity of headroom clearances for two systems of different voltage characteristics for uniformity sake alone does not represent adequate technical justification for the proposal.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2705

1- 127 - (110-16(f)): Reject
SUBMITTER: Robert M. Milatovich, City of Fresno, CA
RECOMMENDATION: 110-16(f) Change 6 1/4 feet (1.91m) to 6 feet 8 inches.
SUBSTANTIATION: The standard height of a door is 6 feet 8 inches.
PANEL ACTION: Reject.
PANEL COMMENT: Doors are not of standardized height. No technical justification for the change was provided.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2426

2- 1 - (110-16(g)-(New)): Reject
SUBMITTER: Michael L. Mills, Newbury Park, CA
RECOMMENDATION: New text:
 (g) Power. All substantial indoor electrical installations in vaults, rooms, areas, or closets shall have at least one 120V single phase 15 or 20 A receptacle.
 Exception: Service equipment or panelboards, in dwelling units that do not exceed 200 amperes.
SUBSTANTIATION: When maintenance needs to make minor modifications they get 30 foot extension chords draping across pedestrian aisles thru the substation door for 120 electric drill etc. Requiring a 120V outlet in "substantial" indoor equipment installations will eliminate extension chords thru substation doors & eliminate electricians from disassembling panels (120V) for temporary 120V power.
PANEL ACTION: Reject.
PANEL COMMENT: "Substantial" is not meaningful. Closets for electrical panels in corridors of commercial buildings generally do not require receptacles. There is no substantiation to require a receptacle in these locations.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 868

1- 129 - (110-17, Heading): Accept in Principle
SUBMITTER: Ad Hoc Subcommittee on Voltages; NEC Correlating Committee
RECOMMENDATION: Revise heading to read:
 110-17. Guarding Live Parts of Low-Voltage Systems.
SUBSTANTIATION: The proposal is to obtain consistency in voltage terminology throughout the Code and to incorporate recognized industry standards and practices. See proposed definitions of low-, medium- and high-voltage circuits, equipment and systems (Article 100 proposals).
 Present text addresses hazards involved with voltages to ground. This voltage level is not being changed.
PANEL ACTION: Accept in Principle.
 Change "live" to "energized".
PANEL COMMENT: To be consistent with NEC Style Manual.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 7
 NEGATIVE: Kitzantides, Summers.
EXPLANATION OF VOTE:
 KITZANTIDES: See NEMA comment on Proposal 1-82.
 SUMMERS: See comments on Proposal 1-80.

Log # 869

1- 130 - (110-17, FPN): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Revise last sentence to read:
 For medium- and high-voltage systems, see Section 110-34.
SUBSTANTIATION: To correlate with proposed change to Article 710 and new definitions of voltage ranges.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 7
 NEGATIVE: Kitzantides, Summers.
EXPLANATION OF VOTE:
 KITZANTIDES: See NEMA Comment on Proposal 1-82.
 SUMMERS: See comments on Proposal 1-80.

Log # 870

1- 131 - (110-17(a)(4)): Accept in Principle
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Add to existing text to read:
 (4) By elevation of 8 feet (2.44m) or more above the floor or other working surface for live parts operating at 600 volts or less, nominal, between phases and 8 feet, 6 inches (2.59m) for live parts operating at 601-1000 volts, nominal, between phases.
SUBSTANTIATION: To correlate with proposed new definitions of voltage ranges. In effect relocates existing requirement for 601-1000 v equipment from Section 110-34(e). See proposed revision to Table 110-34(e).
PANEL ACTION: Accept in Principle.
 Change "live" to "energized" in two places where it appears.
PANEL COMMENT: See Panel Comment on Proposal 1-129.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 7
 NEGATIVE: Kitzantides, Summers.
EXPLANATION OF VOTE:
 KITZANTIDES: See NEMA comment on Proposal 1-82.
 SUMMERS: See comments on Proposal 1-80.

Log # 1800

1- 132 - (110-22): Accept in Principle
 Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for information.
SUBMITTER: Joel A. Rencsok, City of Phoenix, AZ
RECOMMENDATION: Add new paragraph after existing text:
 When circuit breakers or fuses are connected in series to comply with NEC 110-9, 110-10, or 230-65, the enclosures shall be legibly marked to indicate this purpose.
 Such marking shall state (CAUTION-SERIES RATED SYSTEM) and shall be legible without opening or removing any covers or doors.
SUBSTANTIATION: Many installations are being installed using this series rated type system and when additions or alterations to the system are done later no one knows that many electrical systems cannot be altered as was normal prior to UL now listing their systems as an alternate to fully rated electrical systems.
PANEL ACTION: Accept in Principle.
 In paragraph 2 change the following:
 Delete "such" and replace with "In addition field-installed".
 Change "marking" to "markings".
 Delete all after "legible".
 Add after "legible" "and readily visible".
 Paragraph 2 now reads:
 "In addition, field-installed markings shall state "CAUTION: SERIES RATED SYSTEM" and shall be legible and readily visible."
PANEL COMMENT: CMP 1 wishes to clarify that equipment can be marked to denote that enclosures and other components may be utilized in combination to obtain a series rating but only becomes a series rated system when field installed for this purpose. Refer to CMP 4 for information.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Kitzantides.

EXPLANATION OF VOTE:

KITZANTIDES: The proposed marking is impractical in its application and would cause confusion in the field. In addition, there is no definition for "series rated system." Also, the intent of "caution" is not the same as the one defined in nationally recognized standards for precautionary labeling.

COMMENT ON VOTE:

SEELBACH: I believe the word "enclosures" in the Panel Comment is misplaced. It should be in the first line after "equipment". In the second line, "enclosures and" should be deleted.

Log # 2469

1- 133 - (110-22): Reject

SUBMITTER: John Wilder, Lowell, MI

RECOMMENDATION: Revised text:

Identification of Disconnecting Means. Each disconnecting means required by this Code for motors & appliances, & each service, feeders, or Branch Circuit at the point where it originates. Shall be color coated for the diffence voltages & be legibly marked to indicate its purpose. The marking shall be of sufficient to withstand the environment involved.

SUBSTANTIATION: The different colors will make easier to identified the voltage of the disconnect by sight.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is impractical and could lead to safety hazards because each occupancy could use a different color coding scheme resulting in confusion or a sense of unjustified security.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2731

1- 134 - (110-22): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Revised text:

110-22 Identification. Identification marking shall be of sufficient durability to withstand the environment involved.

(a) Disconnecting Means. Each disconnecting means required by this Code shall be legibly marked to inditce its purpose at the point where it originates:

1. Service, feeder, and branch circuits shall be identified.

2. Motor and appliance disconnects shall be identified unless located and arranged so their purpose is evident.

(b) Ground-Fault Circuit Interrupter Protection for Personnel

1. All 125 volt, single-phase, 15 and 20 ampere G.F.C.I. protected receptacles shall be identified.

SUBSTANTIATION: Rearrangement of this section and an additional GFCI identification requirement will assist the authority having jurisdiction in enforcing adequate identification.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation gives no technical justification for requiring the identification of GFCI protected receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2266

1- 135 - (110-23-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 7, 15, 16 and 17 for action on those sections under their responsibility, this action will be considered by the Panel as a Public Comment.

SUBMITTER: Michael J. Chaisson, Cogebi, Inc.

RECOMMENDATION: New text:

110-23. Circuit Integrity. All wiring described in Sections 700-1, 330-1, 517-44, 517-60, 517-61, 517-62, 517-63, 700-18, 725-38(b) (1) (2) (3), 760-16 (b), 760-28 (c) (1), 760-32(b), 770-6(b)(c) shall be insulated such that it complies with IEC-331 and or Mil.C24640, when such cable is used for Emergency and/or Essential electrical systems.

SUBSTANTIATION: Problem: There is no current article defining circuit integrity nor test method for circuit integrity with regard to electrical cable included in the above mentioned articles. Therefore, those specified cables if not properly insulated according to an already established test method (IEC-331 or MIL C24640) would potentially fail (during a fire) in their designated functions.

Substantiation: The U.S. Navy, International Electrical Commission, Japan, France and a number of ther countries, government agencies and private concerns have adopted one of the above test methods to insure circuit integrity where it would be critical in providing life safety for those within the environs where aforementioned cables (see Section 3.) might be used.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The referenced sections are not under the purview of CMP 1. Refer to Code-Making Panels 7, 15, 16 and 17 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2732

1- 136 - (110-23-(New)): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: New text:

110-23. Warning Signs and Plaques. Where required by this Code, all signs and plaques shall conform with the following:

(a) Lettering. All lettering on signs and plaques shall be not less than 1/2" (12.7mm) in height and be of permanent type.

(b) Construction. Signs and plaques shall be constructed of substantial metallic or nonmetallic material.

(c) Installation. All signs and plaques shall be mounted securely and in a readily visible location.

(FPN): See Sections 110-17(c), 110-34(c), 230-2, 230-203, 450-8(d), 513-6(c), 513-11(a), 516-5(c), 620-52(b), 630-42(c), 665-23, 669-7, 700-8 701-9, 702-8, 705-10, 710-21(b)(7)Exc., 710-21(c)(2), 710-21(e), 710-24(o), 710-43, 710-45.

SUBSTANTIATION: Presently this Code requires posting of warning signs and plaques in at least 22 different sections. This new section is obviously necessary to promote a professional installation standard throughout the nation.

PANEL ACTION: Reject.

PANEL COMMENT: Present marking requirements are adequately covered by Section 110-21.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 871

1- 137 - (Article 110, Part B, Title): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise Title to read:

B. Medium- And High-Voltage Circuits And Systems.

SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and to incorporate recognized industry standards and practices. See proposed definitions of low-, medium- and high-voltage circuits, equipment and systems (Article 100 proposals).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers..

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 872

1- 138 - (110-30): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise text to read:

110-30. General. Conductors and equipment used on medium- and high-voltage circuits and systems, shall comply . . . (remainder unchanged).

SUBSTANTIATION: Same as Proposal 1-129.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 2910

1- 139 - (110-31): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add new paragraph to 110-31:

"Enclosed switchgear rooms shall have at least two means of egress, one at each extreme of the area, not necessarily in opposite walls. Doors shall swing out and be equipped with panic bars, pressure plates or other devices that are normally latched but open under simple pressure.

Exception: One door may be used when required by physical limitations if means are provided for unhampered exit during emergencies.

SUBSTANTIATION: Doors to the switchgear room are located in unusual areas and are equipped with conventional twist-type knobs all contributing to a difficult egress in emergency.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-115.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 873

1- 140 - (110-31(b)(1), FPN): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

(FPN): For clearances of conductors in medium- and high-voltage circuits and systems, see National Electrical Safety Code (ANSI C2-1984).

SUBSTANTIATION: Same as Proposal 1-137.

PANEL ACTION: Accept.

PANEL COMMENT: Include the latest reference of the ANSI C2 at the time of the NEC adoption.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 580

1- 141 - (110-31(c)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "general public" to "unqualified persons".

SUBSTANTIATION: To be consistent with the frequent use of "qualified" or "unqualified" used throughout this section and for which there is a Code definition.

Unqualified personnel of independent contractors working within premises where such equipment is installed may not be constrained by plant management due to legal aspects, and may not be equated with the "general public". The proposal would encompass all persons and provide consistency with other Code wording such as in Section 600-35.

PANEL ACTION: Reject.

PANEL COMMENT: CMP 1 believes that the requirements should be applied to both qualified or unqualified persons of the general public. Acts of vandalism are not confined to technically unqualified persons.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2915

1- 142 - (110-32): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to paragraph 110-32:

"Space shall be maintained in front of switchgear to allow breakers, etc., to be removed and turned without obstruction.

SUBSTANTIATION: Designers configure switchgear rooms, etc, without consideration for maintenance requirements of specific tests that requirement access to all parts of the breaker.

PANEL ACTION: Reject.

PANEL COMMENT: It is the opinion of CMP 1 that Sections 110-32 and 110-34 already provide such clearances.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2916

1- 143 - (110-32): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add a new paragraph to 110-32:

"Permanently mounted devices, panelboards, etc located on the walls shall not encroach on the space requirements of Section 110-34(a).

SUBSTANTIATION: Contractors are installing equipment on walls by switchgear thereby defeating intent of Code for a clear and unobstructed work space.

PANEL ACTION: Reject.

PANEL COMMENT: It is the opinion of CMP 1 that Section 110-34(a) already requires such clear work space.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2917

1- 144 - (110-32): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add new paragraph to 110-32

"Where columns extend into the room beyond the wall surface, the face of the column shall not encroach on the space requirements of Table 110-34(a)."

SUBSTANTIATION: Designers configure areas for switchgear without consideration for the obstructions to safe egress caused by projecting columns.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-143.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 696

1- 145 - (110-33): Reject

SUBMITTER: Russ Helmick, Jr., PCEA

RECOMMENDATION: Revise as follows:

(Title) ENTRANCE AND EXIT TO WORKING SPACE. Also in 110-33(a) change the word "entrance" to "doorway" where it occurs. Also change the "24 inch" requirement to "36 inches" to be more consistent with exits.

SUBSTANTIATION: There has been much confusion in both sections about the requirement for two doors, or worse, there have been 24 inch doors installed in electrical rooms. With this proposal we hope to make it clear about distances from equipment and when one door is sufficient or two doors are necessary. Also the 36 inch requirement being a standard for all exit doors. This would increase the safety factor in all electrical type rooms. There has not been a code issue from way back that has not escaped many questions or explanations to be able to understand these two sections. The chance for injury in a electrical room in case there is a accident is very good at present, these changes would perhaps decrease that possibility, it also might make the installations easier for installers and easier for code enforcement persons to interpret. The safety required in electrical rooms of 600 volts or less is hazardous enough, but in high voltage rooms it is much more imperative that we have as much room as possible to not only work, but in which to escape the area in case of accident. These rooms, simply because of the hazards involved should be considered hazardous working areas, and be treated as such.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-115.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 819

1- 146 - (110-33): Reject
SUBMITTER: Joseph L. Giovannello, Brockton, MA
RECOMMENDATION: Revise last sentence as follows:
 "In all cases the work space shall permit at least a 90-degree opening of equipment doors or hinged panels, except where they can be removed."
SUBSTANTIATION: See Section 610-57 and my proposal for Section 110-16(a).
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 1-105.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1787

1- 147 - (110-33): Reject
SUBMITTER: Del St. Laurent, Pacific Coast Electrical Association, Inc.
RECOMMENDATION: Revise as follows:
 110-33 WORKING SPACE, ENTRANCE"/EXIT"
 (a) Entrance"/Exit". At least "one entrance/exit" not less than "36 inches". "(915mm)" wide and 6' " 8"" "(2.03m)" high shall be provided to give access to"/from" the working space about electric equipment.
 On switchboard and control panels exceeding 6 feet (1.83m) in width, there shall be one entrance"/exit" at each end of such board.
 EXCEPTION No. 1: Where the switchboards and panelboards location permits a continuous and unobstructed way of exit travel.
 EXCEPTION No. 2: Where the work space required in Section 110-34(a) is doubled.
 Working space with one entrance"/exit" provided shall be so located that the edge of the entrance"/exit" nearest the switchboards and panelboards is the minimum clear distance given in Table 110-34(a) away from such equipment.
 Where bare energized parts at any voltage or insulated energized parts above 600 volts, nominal, are located adjacent to such entrance"/exit," they shall be suitably guarded.
 Note: Added or revised material in quotations.
SUBSTANTIATION: Same as Proposal 1- (Log #1786).
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 1-115.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 8
 NEGATIVE: Summers.
EXPLANATION OF VOTE:
 SUMMERS: See comments on Proposal 1-119.

Log # 2560, 2703

1- 148 - (110-33): Reject
SUBMITTER: M.E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (Log #2560)
 Robert M. Milatovich, Southwestern Section International Association of Electrical Inspectors (Log #2703)
RECOMMENDATION: Revise (TITLE):
 ENTRANCE AND EXIT TO WORKING SPACE.
 Also in 110-33 (a) change the word entrance to "doorway" where it occurs. Also change the 24 inch requirement to "36 inches" to be more consistent with exits, and a minimum height of 6 feet 8 inches.
SUBSTANTIATION: Companion to proposals for 110-16 (c). There has been much confusion in both sections about the requirements for two doors, or worse, there have been 24 inch doors installed in electrical rooms. With this proposal we hope to make it clear about distances from equipment and when one door is sufficient or two doors are necessary. Also the 36 inch requirement being a standard for all exit doors. This would increase the safety factor in all electrical type rooms. There has not been a Code issue from way back that has not escaped many questions or explanations to be able to understand these two sections. The chance for injury in an electrical room in case there is an accident is very good at present, these changes would perhaps decrease that possibility, it also might make the installations easier for installers and easier for Code enforcement persons to

interpret the safety required in electrical rooms of 600 volts or less is hazardous enough, but in high voltage rooms it is much more imperative that we have as much room as possible to not only work, but, in which to escape the area in case of accident. These rooms, simply because of the hazards involved should be considered hazardous working areas, and be treated as such.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 1-115.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 8
 NEGATIVE: Summers.
EXPLANATION OF VOTE:
 SUMMERS: See comments on Proposal 1-119.

Log # 874

1- 149 - (110-33(a)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Revise last paragraph to read:
 Where bare energized parts at any voltage or insulated energized parts above 600 v, nominal to ground, are located . . . (remainder unchanged).
SUBSTANTIATION: The present text addresses hazards involved with voltages to ground. This voltage level is not being changed.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 7
 NEGATIVE: Kitzantides, Summers.
EXPLANATION OF VOTE:
 KITZANTIDES: See NEMA Comment on Proposal 1-82.
 SUMMERS: See comments on Proposal 1-80.

Log # 2113

1- 150 - (110-33(a)): Reject
SUBMITTER: Brandon Burke, City of Palo Alto, CA
RECOMMENDATION: Revise as follows:
 On switchboard, "panelboards" and control panels exceeding 6 feet (1.83 m) in width, there shall be one entrance at each end of such board.
 Note: Added material in quotations.
SUBSTANTIATION: Addition of PANELBOARD - to maintain consistency within section and avoid exemption of panelboards from the access requirement of this section.
 Exception No. 1 And Paragraph #3 of this section makes reference to ". . . switchboards and panelboards."
 The reference in Paragraph #2 to control panels and not panelboards has led to confusion.
 The inclusion of PANELBOARDS in Paragraph #2 would prevent misinterpretation that this section may apply exclusively to switchboards and control panels (i.e. motor control panels).
PANEL ACTION: Reject.
PANEL COMMENT: Panel 1 is not aware that panelboards are manufactured in the voltage range over 1000 V.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2783

1- 151 - (110-33(a)): Reject
SUBMITTER: Melvin K. Sanders, Ankeny, IA
RECOMMENDATION: Revise section 110-33(a) 3rd paragraph last line so it would read:
 . . . clear distance "based upon the conditions 1, 2, or 3 as given in table 110-33(a) away . . .
 Note: Added material in quotations.
SUBSTANTIATION: As presently worded it is not clear if the minimum of 3 feet applies in all instances or if the additional dimensions of conditions 1, 2, or 3 for the voltages listed must be met.
PANEL ACTION: Reject.
PANEL COMMENT: The application of Section 110-34(a) already requires the use of the 3 "conditions" in order to apply the dimensions of the table.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2692

1- 152 - (110-34(a)3, Exception): Reject
SUBMITTER: Robert M. Milatovich, Southwestern Section
International Association of Electrical Inspectors
RECOMMENDATION: New text:

Where rear access is required to perform voltage tests for correct phase connection on energized parts of enclosed equipment, a minimum working space of five feet horizontally shall be provided.
SUBSTANTIATION: Lockheed Missiles and Space Co. has encountered the hazard of phase checking energized high voltage equipment at rear access switch gear with a work space area 30 inches deep. This equipment was originally installed in conformance with the work space dimension noted in the present exception "where rear access is required to work on de-energized equipment". Consideration was not given for the necessity of phase checking of energized systems after the replacement of new cables. The switch gear is a double-ended sub-station supplied by two separate 12,000 volt circuits inter-connected with a tie breaker. Correct phase connection testing is necessary with the circuits energized.

PANEL ACTION: Reject.

PANEL COMMENT: The exception is only applicable when working on de-energized parts. Where the exception does not apply the basic rule must be used, but 5 feet of space would not necessarily be required.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 375

1- 153 - (Table 110-34(a), Condition No. 1): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise last sentence to read:

Insulated wire or insulated bus bars operating at 300 volts, nominal, or less to ground shall not be considered live parts.

SUBSTANTIATION: Same as Proposal 1-113.

PANEL ACTION: Accept in Principle.

Change "live" to "energized".

PANEL COMMENT: To be consistent with NEC Style Manual.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 581

1- 154 - (110-34(b)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "exposed wiring" to "exposed conductors".

SUBSTANTIATION: Exposed wiring may include raceways and metal-covered cables, even if behind panels designed to allow access. Subsection (c) uses the phrase "exposed live parts or exposed conductors".

The present wording could require a partition, fence, or screen in a room containing a low-voltage switch and high-voltage conductors and equipment enclosed in rigid metal conduit and locked metal enclosures, if accessible to persons performing janitorial work, etc. The wording of subsection (c) does not require such a location (with no exposed live parts or exposed conductors) to be kept locked.

PANEL ACTION: Reject.

PANEL COMMENT: "Wiring" covers other components in addition to conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 876

1- 155 - (110-34(b) and Exception): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise text, including Exception as follows:

(b) Separation from Low-Voltage Equipment. Where switches, cutouts, or other equipment of a low-voltage

system, are installed in a room or enclosure where there are exposed live parts or exposed wiring of a medium- or high-voltage system, the medium- or high-voltage equipment shall be effectively separated . . . (remainder unchanged).

Exception: Switches or other equipment of a low-voltage system, serving only equipment within the medium- or high-voltage vault, room, or enclosure shall be permitted to be installed in the medium- or high-voltage enclosure . . . (remainder unchanged).

SUBSTANTIATION: Same as Proposal 1-137.

PANEL ACTION: Accept in Principle.

Change "live" to "energized".

PANEL COMMENT: To be consistent with NEC Style Manual.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 877

1- 156 - (110-34(c)): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise text to read:

(c) Locked Rooms or Enclosures. The entrances to all buildings, rooms or enclosures containing exposed live parts or exposed conductors of a medium- or high-voltage system shall be kept locked.

Exception: (Unchanged)

For rooms and enclosures containing medium- or high-voltage equipment permanent and conspicuous warning signs shall be provided, . . . (remainder unchanged).

SUBSTANTIATION: Same as Proposal 1-137.

PANEL ACTION: Accept in Principle.

Change "live" to "energized".

PANEL COMMENT: To be consistent with NEC Style Manual.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA Comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

Log # 1743

1- 157 - (110-34(c)): Reject

Secretary's Note: The Correlating Committee informs CMP 1 that CMP 13 has the responsibility for installation practices for circuits and equipment. CMP 1 has the responsibility for general requirements concerning life safety. The Correlating Committee directs that CMP 1 assume responsibility for action.

It was the action of the Correlating Committee that this proposal be referred to CMPs 4, 12 and 13 for information.

SUBMITTER: Michael Alley, BHP-International, Inc.

RECOMMENDATION: Revise as follows:

Locked Rooms or Enclosures. The entrances to all buildings, rooms, or enclosures containing exposed live parts or exposed conductors operating over 600 volts, nominal, shall be kept locked.

Exception: Where such entrances are under the observation of a qualified person at all times.

Where the voltage exceeds 600 volts, nominal, permanent and conspicuous warning signs shall be provided in accordance with section 230-203.

SUBSTANTIATION: The change in the wording of this section will standardize all sections of the National Electric Code in regards to warning signs. This section should be changed along with the following sections:

230-203
 450-8(d)
 665-23
 710-43
 710-45

PANEL ACTION: Reject.

PANEL COMMENT: CMP 13 has primary jurisdiction. Refer to CMP 4 and 12 for information.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

KITZANTIDES: My notes of the meeting indicated that CMP-1 recommended that the proposal be referred to CMP-13 for action and to CMP-4 and CMP-12 for information.

Log # 2720

1- 158 - (110-34(c)-(New)): Reject
SUBMITTER: R. G. Irvine, Suffern, NY
RECOMMENDATION: Add a new paragraph to "110-34(c) Locked Rooms or Enclosures"

"Locks and latches shall be so arranged that the door can be readily and quickly opened from the inside by a pushing motion only. It is the intent to require panic-type door hardware."

SUBSTANTIATION: Convention twist-and-push door hardware is installed on electrical room doors. In the event of an electrical arc and flash the electrical person may lose the use of hands and therefore cannot exit the electrical room equipped with conventional door knobs.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-115.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 878

1- 159 - (Table 110-34(e)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise first number in table from 601 to 1001.

SUBSTANTIATION: To correlate with proposed changes to Article 710 and new definitions of voltage ranges. Also correlates with proposed revision to Section 110-17(a)(4).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

ARTICLE 200 -- USE AND IDENTIFICATION
OF GROUNDED CONDUCTORS

Log # 1098

5- 1 - (Chapter 2 Title, Article 200): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend second line in title as indicated:

... of GROUNDED "(NEUTRAL)" CONDUCTORS

SUBSTANTIATION: This change is needed to more adequately clarify and simplify the Code meaning/intent because, in accordance with this Code, the neutral and the grounded conductor performs the same/similar functions as indicated in Sections 230-31(c) and 230-42(c). Also, this would do much to minimize confusion and misapplication because in some Code sections the term "neutral" is used and in other sections the term "grounded conductor" is used; for example, in Section 200-2 "grounded conductor" is used and in Section 210-4 "neutral" is used.

PANEL ACTION: Reject.

PANEL COMMENT: In many cases, not all, the grounded conductor and the neutral conductor are the same. However, the function is not the same. See definition of "grounded conductor" in Article 100, and "neutral conductor" in Note 10 to Tables 310-16 through 310-31. The "grounded conductor" is a conductor that is intentionally grounded, i.e., whose function it is to be grounded; whereas, the "neutral conductor" is a conductor whose function it is to carry only the unbalance current from the other conductors. Two definite but distinctly different functions. Also, a "grounded circuit conductor" may be used to ground noncurrent-carrying metal parts of equipment, raceways, and other enclosures on the supply side of the service disconnecting means (see Section 250-61).

It is important that these two different functions be recognized for what they are.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3462

5- 3 - (Chapter 2 Title, Articles 200, 250, and 280): Accept

Secretary's Note: See Correlating Committee action on Proposal 2-3.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Change present title from "Wiring Design and Protection" to "Wiring Systems and Protection" or similar.

SUBSTANTIATION: At present, there is a conflict between this title for Chapter Two covering wiring design, and the statement of Section 90-1(c) that "This Code is not intended as a design specification. . . ." This has been mentioned at several meetings this past year this indicates the Code, or portions anyway, does cover designing.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

NEISWENDER: My vote on this is affirmative, however, I don't believe it was the Panel's intent to include Article 250 and 280.

Log # 2781

2- 3 - (Chapter 2 Title, Articles 210, 215, and 220): Accept in Principle

Secretary's Note: The Correlating Committee advises that chapter titles are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Change present title from "Wiring Design and Protection" to "Wiring Systems and Protection" or similar.

SUBSTANTIATION: At present, there is a conflict between this title for chapter two covering wiring design, and the statement of section 90-1(c) that "this Code is not intended as a design specification. . . ." This has been mentioned at several meetings this past year this indicates the Code, or portions anyway, does cover designing.

PANEL ACTION: Accept in Principle.

Change to read "Wiring and Protection".

PANEL COMMENT: "Systems" is not accurate.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3461

4- 1 - (Chapter 2 Title, Articles 225, 230, and 240): Reject

Secretary's Note: See Correlating Committee action on Proposal 2-3.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Change present title from "Wiring Design and Protection" to "Wiring Systems and Protection" or similar

SUBSTANTIATION: At present, there is a conflict between this title for chapter two covering wiring design, and the statement of Section 90-1(c) that "this Code is not intended as a design specification. . . ." This has been mentioned at several meetings this past year. This indicates the Code, or portions anyway, does cover designing.

PANEL ACTION: Reject.

PANEL COMMENT: Refer to Correlating Committee not within scope of Panel 4.

Do not agree with the submitter.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

KASSEBAUM: The submitter has misinterpreted the statement in Section 90-1(c). It is true that the NEC is not a design manual for "untrained" persons. However, it IS a design manual for "trained" persons.

Log # 2303

5- 2 - (Article 200): Reject

SUBMITTER: Thomas B. Moore, Moore's Elect.

RECOMMENDATION: I propose that the terminology "grounded conductor" be changed to "neutral grounded conductor" or "neutral conductor" so that it would be more distinguishable from "grounding electrode conductor."

Log # 2022
6- 192 - (Table 310-80): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2023
6- 193 - (Table 310-81): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2024
6- 194 - (Table 310-82): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2025
6- 195 - (Table 310-83): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2026
6- 196 - (Table 310-84): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 116
6- 180 - (Tables 310-69 through 310-84, Note 3): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the second sentence as indicated:
... electrical duct bank (will have to) "shall" be
...
SUBSTANTIATION: This change is required to conform to the 1984 NEC Style Manual, Part A, A-1a.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2538
6- 181 - (Tables 310-69 through 310-84, Note 3): Accept
SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association
RECOMMENDATION: In paragraph 3, change "Tables 310-77, 310-78, 310-79 and 310-84" to "Tables 310-77, 310-78, 310-79, and 310-80."
SUBSTANTIATION: Correct typographical error.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE XXX -- NEW
ENVIRONMENTAL AIRSPACE NONMETALLIC
WIRING SYSTEM

Log # 3184
8- 1 - (Article XXX-Environmental Airspace Nonmetallic Wiring System-(New)): Reject
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.
SUBMITTER: Ronald R. Bishop, The Carlon Company
RECOMMENDATION: New text:
Article XXX - Environmental Airspace Nonmetallic Wiring System.

A. General
XXX-1. Definition. Environmental airspace nonmetallic wiring system is a combination of a pliable, coilable corrugated nonmetallic raceway of circular cross section and conductors. The combined system shall have fire-resistant and smoke-producing characteristics that are equivalent to any of the raceways with conductors included in Section 300-22(c). (FPN): One method for determining the equivalency of fire-resistant and smoke producing characteristics is UL Subject Number 1844.

B. Tubing
XXX-1. Definition. Environmental airspace nonmetallic tubing is a pliable, coilable corrugated nonmetallic raceway of circular cross section which is listed for the installation of conductors with integral or associated couplings, connectors and fittings.
A pliable raceway is a raceway which can be bent by hand with a reasonable force but without other assistance.

A coilable raceway is a raceway which may be coiled for packaging and shipping purposes and then uncoiled for installation as a wiring method without adversely affecting the physical properties of the raceway.

XXX-2. Other Articles. Where equipment grounding is required by Article 250, a separate equipment grounding conductor shall be installed in the raceway.

XXX-3. Use Permitted. The use of environmental airspace nonmetallic tubing shall be permitted:

1. When installed as a listed system in other space used for environmental air, such as above suspended ceilings. [Section 300-22(c)].

2. Concealed in walls, floors and ceilings.

3. For low voltage systems.

4. Embedded in poured concrete provided fittings identified for the purpose are used.

XXX-4. Uses Not Permitted. Environmental airspace nonmetallic tubing shall not be used:

1. In hazardous (classified) locations.

2. For the support of fixtures or other equipment.

3. Where subject to physical damage.

4. For direct earth burial.

5. For medium- and high-voltage systems.

6. In exposed applications, except above suspended ceilings.

7. Where subject to ambient temperatures exceeding those for which the tubing is listed.

8. For conductors whose insulation temperature limitations would exceed those for which the tubing is listed.

C. Installation.

XXX-5. Size.

(a) Minimum. Tubing smaller than 1/2-inch electrical trade size shall not be used.

(b) Maximum. Tubing larger than 1-inch electrical trade size shall not be used.

XXX-6. Number of Conductors in Tubing. The number of conductors in a single tubing shall not exceed that permitted by the percentage fill in Table 1, Chapter 9.

XXX-7. Reaming. All cut ends of tubing shall be reamed or otherwise finished to remove rough edges.

XXX-8. Joints. All joints between lengths of tubing and between tubing and couplings, fittings and boxes shall be an approved method.

XXX-9. Bends - How Made. Bends in the tubing shall be so made that the tubing will not be injured and the internal diameter of the tubing will not be effectively reduced. Bends shall be permitted to be made manually without auxiliary equipment and the radius of the curve of the inner edge of such bends shall not be less than shown in Table 346-10.

XXX-10. Bends - Number in One Run. A run of tubing between outlet and outlet or outlet and fitting shall not contain more than the equivalent of four quarter bends (360 degrees, total) including those bends located immediately at the outlet or fitting.

XXX-11. Supports - Environmental airspace nonmetallic tubing shall be installed as a complete system as provided in Article 300 and shall be securely fastened in place. Tubing shall be firmly fastened within 3 feet (914 mm) of each outlet box, junction box, cabinet or fitting. Tubing shall be secured at least every 3 feet (914 mm).

XXX-12. Boxes and Fittings.

1. Where environmental airspace nonmetallic tubing is installed as a system in other spaces used for environmental air, boxes and fittings shall comply with the requirements of Section 300-22(c).

2. In all cases, boxes and fittings shall comply with the applicable provisions of Article 370.

XXX-13. Splices and Taps. Splices and taps shall be made only in junction boxes, outlet boxes or conduit bodies. See Article 370.

XXX-14. Bushings. Where a tubing enters a box or other fitting, a bushing or adapter shall be provided to protect the wire from abrasion unless the design of the box or fitting is such as to provide equivalent protection.

(FPN): See Section 373-6(c) for the protection of conductors No. 4 AWG or larger.

XXX-15. Connections to Other Wiring Methods.

1. Connections to rigid nonmetallic conduit and electrical nonmetallic tubing shall be made so that the connection is outside the space used for environmental air.

(FPN): For an installation of environmental airspace nonmetallic tubing above a suspended ceiling, the connection to rigid nonmetallic conduit or electrical nonmetallic tubing would be in the wall below the plane of the ceiling tile.

2. Connection to wiring methods recognized by Section 300-22(c) shall comply with the applicable provisions of Article 370.

D. Construction Specifications.

XXX-16. General. Environmental airspace nonmetallic tubing shall be clearly and durably marked at least every 10 feet (3.05 m) as required in the first sentence of Section 110.21. The type of material shall also be included in the marking. The tubing may be supplied in coils, reels, or straight lengths.

SUBSTANTIATION: This proposal introduces a new concept to NEC; that is, a system utilizing conductors and a combustible nonmetallic raceway with low-smoke and low-flame-spread characteristics being required of the system. This is an alternate to my proposal for a new article, Nonmetallic Environmental Airspace Tubing in that it covers the system rather than just the tubing.

This proposal will require that the system be evaluated for low-smoke and low-flame-spread requirements that are yet to be determined by

Underwriters Laboratories. A companion proposal for Section 300-22(c) will require that the system be specifically listed for installation in other space used for environmental air. This requirement will assure building owners, standards makers, the fire service, engineers, and installers that the system will not add to the fire hazard for a building or the occupants.

Currently, General Electric Ultem® 1000 shows considerable promise for the raceway portion of the proposed system. Ultem has excellent high heat properties along with low-flame-spread and low-smoke characteristics.

Underwriters Laboratories is preparing a fact finding report which will be available for review by the code panel. In the interim, UL Letter Report, November 4, 1987, File R13106, Project No. 87NK11793 contains a summary of test results, some of which are extracted for use with this proposal.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

From an electrical safety viewpoint, the following tests have been conducted on the raceway portion of the system:

Tension and Elongation*
Arcing
Horizontal Pull In*
Vertical Pull In*
Heat Deflection (Wire Pull)*
Thermal Expansion
Resistance to Mechanical Abuse*
Low Temperature Handling*
Crush
Impact*
Water Absorption
Flammability
Specific Gravity
Pull Through (Wall) Stud Test*
Accelerated Oven Aging
Oven Cycling Conditioning
Low Temperature Wire Pull

Those results marked with an * indicate results not adequate to support listing of the product. The deficiencies appear to be resolvable through material modification or improvements in extrusion technology.

PANEL ACTION: Reject.

PANEL COMMENT: The UL Fact Findings Report was not received with the proposal. The product does not presently meet the requirements of raceways.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ENVIRONMENTAL AIRSPACE NONMETALLIC WIRING SYSTEM SIMULATED PLENUM FIRE TESTS RESULTS

TEST NO.	PRODUCT	SIZE	WIRE ¹	TOTAL-SMOKE RELEASED IN DUCT-OPTICAL DENSITY-FT ²	TOTAL HEAT RELEASED(KJ)
5	EANT	1/2"	10 FEP	7679	97550
8	FLEX.ALUM	1/2"	10 THHN	3017	89625
4	EMT	1/2"	10 THHN	3300	84453
12	EANT	3/4"	18 FEP	6637	92414
7	FLEX.ALUM.	3/4"	18 THHN	4123	86872
3	EMT	3/4"	18 THHN	3548	89717
11	EANT	1"	29 FEP	8274	99860
10	FLEX.ALUM.	1"	29 THHN	4063	85298
1	EMT	1"	29 THHN	3168	78189
CTL#1				3663	85273
CLT#2				2110	102181

¹All wire #12 AWG

ENVIRONMENTAL AIRSPACE NONMETALLIC WIRING SYSTEM
LABORATORY FLAMMABILITY TEST RESULTS

TEST NO.	PRODUCT	SIZE	WIRE ¹	FLAME TRAVEL- FT.	OPTICAL PEAK	DENSITY AVERAGE
5	EANT	1/2"	10 FEP	4.5	0.48	0.06
6	EANT	1/2"	10 FEP	4.0	0.55	0.05
3	FLEX.ALUM.	1/2"	10 THHN	4.0	0.93	0.20
4	FLEX.ALUM.	1/2"	10 THHN	4.5	1.33	0.27
25	EMT	1/2"	10 THHN	7.0	1.09	0.33
27	EMT	1/2"	10 THHN	4.5	0.86	0.24
24	EANT	3/4"	18 FEP	4.0	0.66	0.08
10	FLEX.ALUM.	3/4"	18 THHN	3.0	1.08	0.28
15	FLEX.ALUM.	3/4"	18 THHN	4.0	1.26	0.30
23	EMT	3/4"	18 THHN	5.0	1.33	0.34
30	EMT	3/4"	18 THHN	4.5	1.41	0.33
14	EANT	1"	29 FEP	4.5	0.14	0.02
18	EANT	1"	29 FEP	4.5	0.47	0.06
31	EANT	1"	29 FEP	5.0	0.08	0.02
32	EANT	1"	29 FEP	6.0	0.13	0.02
19	FLEX.ALUM.	1"	29 THHN	5.0	1.53	0.45
20	FLEX.ALUM.	1"	29 THHN	4.5	1.30	0.41
9	EMT	1"	29 THHN	8.0	1.50	0.60
29	EMT	1"	29 THHN	3.0	1.28	0.35

¹All wire #12 AWG

ARTICLE XXX --- NEW
NONMETALLIC ENVIRONMENTAL AIRSPACE TUBING

Log # 3182

8- 2 - (Article XXX-Nonmetallic Environmental Airspace Tubing-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.

SUBMITTER: Ronald R. Bishop, The Carlon Company

RECOMMENDATION: New text:

Article XXX-Nonmetallic Environmental Airspace Tubing.

A. General

XXX-1. Definition. Nonmetallic environmental airspace tubing is a pliable, coilable corrugated nonmetallic raceway of circular cross section which has adequate low-smoke and low-flame-spread characteristics with integral or associated couplings, connectors and fittings listed for the installation of conductors.

(FPN): One method of determining adequate low-smoke and low-flame-spread characteristics is UL Subject Number 1842.

A pliable raceway is a raceway which can be bent by hand with a reasonable force but without other assistance.

A coilable raceway is a raceway which may be coiled for packaging and shipping purposes and then uncoiled for installation as a wiring method without adversely affecting the physical properties of the raceway.

XXX-2. Other Articles. Where nonmetallic environmental airspace tubing is installed in spaces used for environmental air, the installation shall comply with the provisions of Section 300-22(c). Where equipment grounding is required by Article 250, a separate equipment grounding conductor shall be installed in the raceway.

XXX-3. Uses Permitted. The use of nonmetallic environmental airspace tubing shall be permitted:

1. In other space used for environmental air, such as above suspended ceilings [Section 300-22(c)].
2. Concealed in walls, floors, and ceilings.
3. For low voltage systems.
4. Embedded in poured concrete, provided fittings identified for the purpose are used.

XXX-4. Uses Not Permitted. Nonmetallic environmental airspace tubing shall not be used:

1. In hazardous (classified) locations.
2. For the support of fixtures or other equipment.
3. Where subject to physical damage.
4. For direct earth burial.
5. For medium- and high-voltage systems.
6. In exposed applications, except above suspended ceilings.

7. Where subject to ambient temperatures exceeding those for which the tubing is listed.

8. For conductors whose insulation temperature limitations would exceed those for which the tubing is listed.

B. Installation

XXX-5. Size.

(a) Minimum. Tubing smaller than 1/2-inch electrical trade size shall not be used.

(b) Maximum. Tubing larger than 1-inch electrical trade size shall not be used.

XXX-6. Number of Conductors in Tubing. The number of conductors in a single tubing shall not exceed that permitted by the percentage fill in Table 1, Chapter 9.

XXX-7. Reaming. All cut ends of tubing shall be reamed or otherwise finished to remove rough edges.

XXX-8. Joints. All joints between lengths of tubing and between tubing and couplings, fittings and boxes shall be an approved method.

XXX-9. Bends- How Made. Bends in the tubing shall be so made that the tubing will not be injured and the internal diameter of the tubing will not be effectively reduced. Bends shall be permitted to be made manually without auxiliary equipment and the radius of the curve of the inner edge of such bends shall not be less than shown in Table 346-10.

XXX-10. Bends - Number in One Run. A run of tubing between outlet and outlet or outlet and fitting shall not contain more than the equivalent of four quarter bends (360 degrees, total) including those bends located immediately at the outlet or fitting.

XXX-11. Supports. Nonmetallic environmental airspace tubing shall be installed as a complete system as provided in Article 300 and shall be securely fastened in place. Tubing shall be firmly fastened within 3 feet (914 mm) of each outlet box, junction box, cabinet or fitting. Tubing shall be secured at least every 3 feet (914 mm).

XXX-12. Boxes and Fittings.

1. Where nonmetallic environmental airspace tubing is installed in other spaces used for environmental air, boxes and fittings shall comply with the requirements of Section 300-22(c).

2. In all cases, boxes and fittings shall comply with the applicable provisions of Article 370.

XXX-13. Splices and Taps. Splices and taps shall be made only in junction boxes, outlet boxes or conduit bodies. See Article 370.

Submitted material has been reproduced as received.
See note on Page 1.

XXX-14. Bushings. Where a tubing enters a box or other fitting, a bushing or adapter shall be provided to protect the wire from abrasion unless the design of the box or fitting is such as to provide equivalent protection.

(FPN): See Section 373-6(c) for the protection of conductors No. 4 AWG or larger.

XXX-15. Connections to Other Wiring Methods.

1. Connections to rigid nonmetallic conduit and electrical nonmetallic tubing shall be made so that the connection is outside the space used for environmental air.

(FPN): For an installation of nonmetallic environmental airspace tubing above a suspended ceiling, the connection to rigid nonmetallic conduit or electrical nonmetallic tubing would be in the wall below the plane of the ceiling tile.

2. Connections to wiring methods recognized by Section 300-22(c) shall comply with the applicable provisions of Article 370.

C. Construction Specifications.

XXX-16. General. Nonmetallic environmental airspace tubing shall be clearly and durably marked at least every 10 feet (3.05 m) as required in the first sentence of Section 110.21. The type of material shall also be included in the marking. The tubing may be supplied in coils, reels, or straight lengths.

SUBSTANTIATION: This proposal introduces a new concept to the NEC; that is, a combustible raceway in other spaces used for environmental air. Thus, an evaluation of candidate materials must include fire hazard characteristics as well as electrical safety concerns. Currently, General Electric Ultem® 1000 shows considerable promise for this application. Ultem has excellent high heat properties along with low-flame-spread and low-smoke characteristics.

This proposal will require that a nonmetallic raceway be evaluated for low-smoke and low-flame-spread requirements according to a yet to be developed procedure by Underwriters Laboratories. A companion proposal for Section 300-22(c) also requires that the raceway contain only conductors which have been

evaluated for adequate fire-resistant and low-smoke-producing characteristics according to NFPA 262-1985 when the raceway is installed in other spaces used for environmental air. This will assure building owners, engineers, and installers that the raceway will not add to the fire hazard for a building or the occupants.

Underwriters Laboratories is preparing a fact-finding report which will be available for review by the code panel. In the interim, UL Letter Report, November 4, 1987, File R13106, Project No. 87NKL1793 contains a summary of test results, some of which are extracted for use with this proposal.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

From an electrical safety viewpoint, the following tests have been conducted:

Tension and Elongation*
Arcing
Horizontal Pull In*
Vertical Pull In*
Heat Deflection (Wire Pull)*
Thermal Expansion
Resistance Mechanical Abuse*
Low Temperature Handling*
Crush
Impact*
Water Absorption
Flammability
Specific Gravity
Pull Through (Wall) Stud Test*
Accelerated Oven Aging
Oven Cycling Conditioning
Low Temperature Wire Pull

Those results marked with an * indicate results not adequate to support listing of the product. The deficiencies appear to be resolvable through material modification or improvements in extrusion technology.

PANEL ACTION: Reject.

PANEL COMMENT: UL Fact Finding Report was not received with the proposal. The product does not presently meet the requirements of raceways.

VOTE ON PANEL ACTION: Unanimously Affirmative.

NONMETALLIC ENVIRONMENTAL AIRSPACE TUBING SIMULATED PLENUM TEST RESULTS

TEST NO.	SIZE	TOTAL SMOKE RELEASED IN DUCT - OPTICAL DENSITY - FT ²	TOTAL HEAT RELEASED (Kj)
14	1/2"	6117	84858
13	3/4"	6058	95440
9	1"	5728	82409
CTL#1		3663	85273
CTL#2		2110	102181

NONMETALLIC ENVIRONMENTAL AIRSPACE TUBING LABORATORY FLAMMABILITY TESTS RESULTS

TEST NO.	SIZE	FLAME TRAVEL - FT.	SMOKE OPTICAL PEAK	SMOKE DENSITY AVE.
1	1/2"	4.5	0.75	0.07
2	1/2"	4.5	0.43	0.05
8	3/4"	6.5	0.72	0.08
12	3/4"	7.0	0.53	0.07
13	3/4"	7.0	0.89	0.08
7	1"	8.0	0.72	0.08
11	1"	4.5	0.56	0.06
22	1"	4.5	0.35	0.03
26	1"	5.0	0.25	0.03

COMMENT ON VOTE:

KITZANTIDES: My notes of the meeting indicated that CMP-1 recommended that the proposal be referred to CMP-13 for action and to CMP-4 and CMP-12 for information.

Log # 2720

1- 158 - (110-34(c)-(New)): Reject
SUBMITTER: R. G. Irvine, Suffern, NY
RECOMMENDATION: Add a new paragraph to "110-34(c) Locked Rooms or Enclosures"

"Locks and latches shall be so arranged that the door can be readily and quickly opened from the inside by a pushing motion only. It is the intent to require panic-type door hardware."

SUBSTANTIATION: Convention twist-and-push door hardware is installed on electrical room doors. In the event of an electrical arc and flash the electrical person may lose the use of hands and therefore cannot exit the electrical room equipped with conventional door knobs.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 1-115.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 878

1- 159 - (Table 110-34(e)): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise first number in table from 601 to 1001.

SUBSTANTIATION: To correlate with proposed changes to Article 710 and new definitions of voltage ranges. Also correlates with proposed revision to Section 110-17(a)(4).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Kitzantides, Summers.

EXPLANATION OF VOTE:

KITZANTIDES: See NEMA comment on Proposal 1-82.

SUMMERS: See comments on Proposal 1-80.

ARTICLE 200 -- USE AND IDENTIFICATION
OF GROUNDED CONDUCTORS

Log # 1098

5- 1 - (Chapter 2 Title, Article 200): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend second line in title as indicated:

... of GROUNDED "(NEUTRAL)" CONDUCTORS

SUBSTANTIATION: This change is needed to more adequately clarify and simplify the Code meaning/intent because, in accordance with this Code, the neutral and the grounded conductor performs the same/similar functions as indicated in Sections 230-31(c) and 230-42(c). Also, this would do much to minimize confusion and misapplication because in some Code sections the term "neutral" is used and in other sections the term "grounded conductor" is used; for example, in Section 200-2 "grounded conductor" is used and in Section 210-4 "neutral" is used.

PANEL ACTION: Reject.

PANEL COMMENT: In many cases, not all, the grounded conductor and the neutral conductor are the same. However, the function is not the same. See definition of "grounded conductor" in Article 100, and "neutral conductor" in Note 10 to Tables 310-16 through 310-31. The "grounded conductor" is a conductor that is intentionally grounded, i.e., whose function it is to be grounded; whereas, the "neutral conductor" is a conductor whose function it is to carry only the unbalance current from the other conductors. Two definite but distinctly different functions. Also, a "grounded circuit conductor" may be used to ground noncurrent-carrying metal parts of equipment, raceways, and other enclosures on the supply side of the service disconnecting means (see Section 250-61).

It is important that these two different functions be recognized for what they are.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3462

5- 3 - (Chapter 2 Title, Articles 200, 250, and 280): Accept

Secretary's Note: See Correlating Committee action on Proposal 2-3.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Change present title from "Wiring Design and Protection" to "Wiring Systems and Protection" or similar.

SUBSTANTIATION: At present, there is a conflict between this title for Chapter Two covering wiring design, and the statement of Section 90-1(c) that "This Code is not intended as a design specification. . . ." This has been mentioned at several meetings this past year this indicates the Code, or portions anyway, does cover designing.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

NEISWENDER: My vote on this is affirmative, however, I don't believe it was the Panel's intent to include Article 250 and 280.

Log # 2781

2- 3 - (Chapter 2 Title, Articles 210, 215, and 220): Accept in Principle

Secretary's Note: The Correlating Committee advises that chapter titles are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Change present title from "Wiring Design and Protection" to "Wiring Systems and Protection" or similar.

SUBSTANTIATION: At present, there is a conflict between this title for chapter two covering wiring design, and the statement of section 90-1(c) that "this Code is not intended as a design specification. . . ." This has been mentioned at several meetings this past year this indicates the Code, or portions anyway, does cover designing.

PANEL ACTION: Accept in Principle.

Change to read "Wiring and Protection".

PANEL COMMENT: "Systems" is not accurate.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3461

4- 1 - (Chapter 2 Title, Articles 225, 230, and 240): Reject

Secretary's Note: See Correlating Committee action on Proposal 2-3.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Change present title from "Wiring Design and Protection" to "Wiring Systems and Protection" or similar

SUBSTANTIATION: At present, there is a conflict between this title for chapter two covering wiring design, and the statement of Section 90-1(c) that "this Code is not intended as a design specification. . . ." This has been mentioned at several meetings this past year. This indicates the Code, or portions anyway, does cover designing.

PANEL ACTION: Reject.

PANEL COMMENT: Refer to Correlating Committee not within scope of Panel 4.

Do not agree with the submitter.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

KASSEBAUM: The submitter has misinterpreted the statement in Section 90-1(c). It is true that the NEC is not a design manual for "untrained" persons. However, it IS a design manual for "trained" persons.

Log # 2303

5- 2 - (Article 200): Reject

SUBMITTER: Thomas B. Moore, Moore's Elect.

RECOMMENDATION: I propose that the terminology "grounded conductor" be changed to "neutral grounded conductor" or "neutral conductor" so that it would be more distinguishable from "grounding electrode conductor."

SUBSTANTIATION: In the trade, the word "neutral" is always used when referring to the "grounded conductor" as the NEC calls it. I have never heard another electrician call it a "grounded conductor" only in the Code Book is it referred to that way. It is very confusing to men learning the trade in the field, because "old" electricians in the trade use the word neutral. The men learning are looking for "neutral" when the Code is using "grounded conductor."
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 5-1.
Submitter did not specify where to insert the words.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1099

5- 4 - (200-1): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second and third lines in the sentence as indicated:
... grounded "(neutral)" conductor ...
... identification of grounded "(neutral)" conductors.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 879

5- 5 - (200-2): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: In second to last line replace "1kV" with "1000 volts".
SUBSTANTIATION: For consistency within the Code.
PANEL ACTION: Accept.
PANEL COMMENT: Contingent on CMP 1 acceptance of the whole voltage philosophy.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1100

5- 6 - (200-2): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first lines in the first and second paragraphs as indicated:
... have a grounded "(neutral)" conductors ...
... grounded "(neutral)" conductor, when ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 69

5- 7 - (200-3): Accept in Principle.
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the second paragraph as indicated:
... "a" connection "that is" capable of carrying current ...
SUBSTANTIATION: Editorial - to improve clarity and grammatical order.
PANEL ACTION: Accept in Principle.
In the second paragraph of the Code text, rewrite it to read as follows:
"For the purpose of this section, "electrically connected" shall mean connected, so as to be capable of carrying current ... induction."
PANEL COMMENT: The Panel believes these words meet the submitter's intent.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1101

5- 8 - (200-3): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the sentence as indicated:
... grounded "(neutral)" conductor of ...

Submitted material has been reproduced as received.
See note on Page 1.

SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2733

5- 9 - (200-3): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Revise the first sentence to read:
"Premises and utilization equipment wiring ..."
SUBSTANTIATION: This revision is an attempt to deal with the increasing problems arising from improper installation of electronics equipment power systems.
PANEL ACTION: Reject.
PANEL COMMENT: There is no technical justification for the revision and the proposal does not identify a problem.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 793

5- 10 - (200-3, FPN-(New)): Reject
SUBMITTER: Joe Tedesco, Weymouth, MA
RECOMMENDATION: Revise the second paragraph to become a fine print note, delete the word shall and change the word "mean" to "means".
SUBSTANTIATION: The same words appear as a (FPN) in Section 668-3(b).
PANEL ACTION: Reject.
PANEL COMMENT: No problem cited. It would change a mandatory requirement to nonmandatory status.
For purposes of this section, it is needed as stated.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2734

5- 11 - (200-4-(New)): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: New text:
Circuitry. The grounded conductor shall be limited to installation practices similar to ungrounded conductors.
(a) In multiwire services, feeders and branch circuits the grounded conductor shall comply with Sections 220-22, 225-7(b), and 300-20.
(b) Where a change occurs in the size of an ungrounded conductor, a similar change shall be permitted to be made in the size of the grounded conductor.
(c) The grounded conductor shall be insulated unless specifically exempted by other sections of this code.
SUBSTANTIATION: This new section is long overdue in Article 200. It consolidates Code sections dealing with the installation of the grounded conductor.
PANEL ACTION: Reject.
PANEL COMMENT: In paragraph (a) of the proposal it is redundant to add this section to the article.
Paragraph (b) is covered by Section 240-23.
Paragraph (c) is a statement of existing fact, for example in Section 310-2(a).
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1102

5- 12 - (200-6, Heading): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend heading as indicated:
... Identifying grounded "(Neutral)" Conductors.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1103

5- 13 - (200-6(a)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line in the sentence as indicated:
... insulated grounded "(neutral)" conductor of ...

SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2467

5- 14 - (200-6(a)): Reject
SUBMITTER: Fred Syswerda, Wyoming, MI
RECOMMENDATION: An insulated grounded conductor of No. 6 or smaller shall be identified by a continuous white outer finish for circuits 120 volts or less and a continuous natural gray outer finish for circuits of 277 volts.
SUBSTANTIATION: To help identification of neutrals of different voltage systems.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 5-26.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 10
NEGATIVE: Bessine.
EXPLANATION OF VOTE:
BESSINE: Reason for not voting with panel on Proposal #05 014 - I feel that the original proposal of using gray or white wire for identification should be white or gray on 120 volt, but that 277 volt neutral should be of a white or gray with a black tracer. The gray or white wire after aging can become similar in color. The reason I feel this change is necessary is to go along with Article 90-1A.

Log # 2227

5- 15 - (200-6(a), (b) and (d)): Reject
SUBMITTER: Joseph Penachio, Revere, MA
RECOMMENDATION: In (a) delete the term "natural gray".
In (b) delete the term "natural gray".
In (d), in the 5th line, insert the words "natural gray or" after the words "outer covering of".
(correlate with Section 210-5(a), and Section 310-12).
SUBSTANTIATION: Years ago when some insulation compounds could not be produced in a white color, natural gray was permitted. In today's real world white colored conductors are readily available and gray should not be permitted for "the other system". Tracer conductors are really not popular in today's market.
PANEL ACTION: Reject.
PANEL COMMENT: There is no technical justification for the proposal. Gray insulated conductors are used to identify grounded conductors, and no problems have been identified.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 681

5- 16 - (200-6(a), Exception No. 3): Accept
SUBMITTER: Joseph S. Dudor, Midway City, CA
RECOMMENDATION: Delete entire Exception No. 3.
SUBSTANTIATION: With the addition of Section 200-6(d), the addition of Exception No. 3 in the 1987 NEC was redundant. All of the conditions covered by the reference to Section 210-5(a) are already covered by Exceptions 4 and 5 to Section 200-6(a) and the new Section 200-6(d). As Section 200-6(d) is more inclusive than Exception No. 3 to Section 200-6(a), it properly should be retained, as noted in the Panel's comment to Proposal 5-6 in NEC-TCR-86-A.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1104

5- 17 - (200-6(a), Exception No. 4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the sentence as indicated:
... the installation, grounded "(neutral)" conductors in ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1105

5- 18 - (200-6(a), Exception No. 5): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line in the sentence as indicated:
... grounded "(neutral)" conductor of a ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1106

5- 19 - (200-6(b)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line in the first sentence and the second line in second sentence as indicated:
... insulated grounded "(neutral)" conductor larger ...
... on the grounded "(neutral)" conductor.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 582

5- 20 - (200-6(b), Exception): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Delete the exception.
SUBSTANTIATION: This exception is superfluous and redundant, as the same permission is contained in the rule, except in the exception conductors in multiconductor cables are only permitted to be marked at terminations WHERE QUALIFIED PERSONS SERVICE THE INSTALLATION. This restriction does not appear to be warranted for larger than No. 6 conductors simply because they are in multiconductor cable form.
If this proposal is accepted Section 210-5(a) Exception No. 2 should be deleted.
PANEL ACTION: Reject.
PANEL COMMENT: The exception permits the use of "other equally effective means" and is a necessary exception.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1107

5- 21 - (200-6(b), Exception): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the Exception as indicated:
... the installation, grounded "(neutral)" conductors ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1108

5- 22 - (200-6(c)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the sentence as indicated:
... grounded "(neutral)" conductor, where ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1109

5- 23 - (200-6(d)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend Heading as indicated:
Grounded "(Neutral)" Conductors of ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1110

5- 24 - (200-6(d)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the first and the second line in the second sentences as indicated:
... system grounded "(neutral)" conductor, if required, ...
... grounded "(neutral)" conductor, if required, ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1111

5- 25 - (200-7): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the sentence as indicated:
... for the grounded "(neutral)" conductor.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3157

5- 26 - (200-7): Reject
SUBMITTER: Tom Rea, El Segundo, CA
RECOMMENDATION: Amending the first paragraph to read:
(a) A continuous white covering on a conductor or a termination marking of white shall be used only for the grounded conductor of 120-volt or less systems.
(b) A continuous gray color covering on a conductor or a termination marking of gray color shall be used only for the grounded conductor of 277-volt systems.
SUBSTANTIATION: This suggested change is important to the safety of the electricians working on the 277 volt systems. A quick identification of the grounded conductor will be a major step towards reducing the frequencies of injury and death from electrocution which is occurring far too often. The gray color as recommended is not to be construed as natural gray which is more or less an off-white. After consulting with one Doctor to see if the color blind people might not be able to see the difference between white and gray he assured me they would have no problem distinguishing between these two. At the Thirty Third Convention of the International Brotherhood of Electrical Workers this resolution of gray for the grounded conductor of 277 volt systems was presented on the floor by local union 11 and passed unanimously by a vote of 2833 which was representing 874,450 electrician members. These are the people who are installing and working with the 277 volt systems. Shouldn't we as intelligent people in the trade try to incorporate every possible safety means and pay attention to these voices, or do we turn our backs on this problem.
NOTE: Supporting Material Available For Review At NFPA Headquarters.
PANEL ACTION: Reject.
PANEL COMMENT: This proposal could create a hazardous situation in extensions or modification to existing installations where white may not indicate 120 volts.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 583

5- 27 - (200-7, Exception No. 3): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Delete: "for connecting an appliance".
SUBSTANTIATION: This exception should not be limited to an "appliance" but should include motors, pendant switches and outlets, controls, etc. In addition the present wording is such that the appliance is the equipment having one conductor identified.
PANEL ACTION: Reject.
PANEL COMMENT: It is the intent of the Panel that this apply to appliances only and no justification has been provided to remove the words "for connecting an appliance".
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 28 - (200-7, Exception No. 3): Accept
SUBMITTER: CMP 5
RECOMMENDATION: Insert two commas as follows:
"A flexible cord, for connecting an appliance, having ..."
SUBSTANTIATION: The change clarifies that the identified conductor is on the flexible cord not on the appliance.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1112

5- 29 - (200-7, Exception No. 3): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the fourth line in the sentence as indicated:
... having a grounded "(neutral)" conductor.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2461

5- 30 - (200-9): Reject
SUBMITTER: James Kujawa, Kentwood, MI
RECOMMENDATION: Revised text:
A. Terminal identification of ungrounded conductors shall be of a brass or copper color.
B. Terminal identification of grounding conductors shall be of a green color or tint.
SUBSTANTIATION: Better identification of terminals.
PANEL ACTION: Reject.
PANEL COMMENT: Substantiation does not support the proposal.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2472

5- 31 - (200-9): Reject
SUBMITTER: Jerry Pitsch, Grand Rapids, MI
RECOMMENDATION: Revised text.
The identification of terminals to which a grounded conductor is to be connected shall be substantially white or silver in color. The identification of other terminals shall be of a readily distinguishable different color (ungrounded terminals shall be brass or black darker in color, grounding terminal shall be green).
SUBSTANTIATION: To clarify the article.
PANEL ACTION: Reject.
PANEL COMMENT: Submitter does not identify a problem nor is there any substantiation for change.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2491

5- 32 - (200-9): Reject
SUBMITTER: Dennis Lang, Ada, MI
RECOMMENDATION: Revised text:
200-9 Mean of Identification of Terminals.
The identification of terminals to which a grounded conductor is to be connected shall be substantially (silver) in color the identification of other used as load size shall be distinguishable brass color.
SUBSTANTIATION: I have never seen a white terminal on receptacle or other fixtures.
PANEL ACTION: Reject.
PANEL COMMENT: There are devices marked "white".
See Panel Comment for Proposal 5-31.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1113

5- 33 - (200-9, Exception): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the exception as indicated:
... grounded "(neutral)" conductors shall be permitted ...

SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 584

5- 34 - (200-10(a), Exception No. 2): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Delete.
SUBSTANTIATION: The rule in (a) applies to devices for connection to more than one side of the line which therefore exempts single-pole devices and makes the exception superfluous. The present exception is not actually an exception to the rule which only concerns devices connected to more than one side of the line.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1120

5- 35 - (200-10(b)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line as indicated:
... for connection to the grounded (white)
"neutral" conductor identified.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 36 - (200-10(b)): Accept
SUBMITTER: CMP 5
RECOMMENDATION: Delete the fourth paragraph from Section 200-10(b) and relocate it as a new Section 250-119.
Identify Section 250-119 as follows:
"250-119. Identification of Wiring Device Terminals."
Add a new fine print note to Section 200-10(b) as follows:
"See Section 250-119 for identification of wiring device equipment grounding conductor terminals."
SUBSTANTIATION: A rule on equipment grounding conductors or terminals does not fall under the scope of Article 200. It belongs in Article 250.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1114

5- 37 - (200-10(c)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line as indicated:
... grounded "(neutral)" conductor shall be ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1571

5- 38 - (200-10(c), Exception-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 200-10(c), add new Exception as indicated:
"Exception: Where 2-wire nonpolarized attachment plugs are permitted."
SUBSTANTIATION: Terminal identification for nonpolarized attachment plugs is not required in accordance with Section 200-10(b), Exception; therefore, the existing Exception also applies to such screw-shell terminals (connections).
PANEL ACTION: Reject.
PANEL COMMENT: There is no permission to use nonpolarized 2-wire attachment plugs. See Section 410-42.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1115

5- 39 - (200-10(d)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the second sentence as indicated:
... the grounded "(neutral)" conductor.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1116

5- 40 - (200-10(e)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the last line in the sentence as indicated:
... the grounded "(neutral)" circuit conductor ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1117

5- 41 - (200-11): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line as indicated:
... grounded "(neutral)" conductor shall ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 210 -- BRANCH CIRCUITS

Log # 3

2- 2 - (Articles 210, 215, 220): Accept
Secretary's Note: The following proposal consists of Comment 2-4 on Proposal 2-2 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 2-2 was as follows:
NOTE: The word "approved" should be removed from every section where used in the NEC and replaced with the word "acceptable," where it does reference listing and labeling by a nationally recognized testing laboratory.
SUBMITTER: Joseph A. Tedesco, Weymouth, MA
RECOMMENDATION: Replace the word "Acceptable" in section 210-21(b)(4) with the word "permitted."
Revise the second sentence of Section 210-23 as follows:
"An individual branch circuit shall be permitted to supply any load for which it is rated."
Revise Section 220-2(c)(5), Exception No. 2 as follows:
Exception No. 2: Table 220-19 shall be permitted for computing the load of household electric range(s).
SUBSTANTIATION: The word "approved" is not used in the Articles assigned to Code Making Panel 2. The word "Acceptable" is used and should be removed and revised as I have recommended above.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 880

2- 4 - (210-2): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: In tabulation change title of Article 710 to "Medium- and High-Voltage Systems".
SUBSTANTIATION: For correlation with proposed change in title of Article 710.
PANEL ACTION: Accept.
PANEL COMMENT: The Panel accepts the proposal for correlation contingent upon the acceptance by Panel 13 of the related changes in Article 710.
VOTE ON PANEL ACTION: Unanimously Affirmative.

SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 584

5- 34 - (200-10(a), Exception No. 2): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Delete.
SUBSTANTIATION: The rule in (a) applies to devices for connection to more than one side of the line which therefore exempts single-pole devices and makes the exception superfluous. The present exception is not actually an exception to the rule which only concerns devices connected to more than one side of the line.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1120

5- 35 - (200-10(b)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line as indicated:
... for connection to the grounded (white)
"neutral" conductor identified.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 36 - (200-10(b)): Accept
SUBMITTER: CMP 5
RECOMMENDATION: Delete the fourth paragraph from Section 200-10(b) and relocate it as a new Section 250-119.
Identify Section 250-119 as follows:
"250-119. Identification of Wiring Device Terminals."
Add a new fine print note to Section 200-10(b) as follows:
"See Section 250-119 for identification of wiring device equipment grounding conductor terminals."
SUBSTANTIATION: A rule on equipment grounding conductors or terminals does not fall under the scope of Article 200. It belongs in Article 250.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1114

5- 37 - (200-10(c)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line as indicated:
... grounded "(neutral)" conductor shall be ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1571

5- 38 - (200-10(c), Exception-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 200-10(c), add new Exception as indicated:
"Exception: Where 2-wire nonpolarized attachment plugs are permitted."
SUBSTANTIATION: Terminal identification for nonpolarized attachment plugs is not required in accordance with Section 200-10(b), Exception; therefore, the existing Exception also applies to such screw-shell terminals (connections).
PANEL ACTION: Reject.
PANEL COMMENT: There is no permission to use nonpolarized 2-wire attachment plugs. See Section 410-42.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1115

5- 39 - (200-10(d)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the second sentence as indicated:
... the grounded "(neutral)" conductor.
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1116

5- 40 - (200-10(e)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the last line in the sentence as indicated:
... the grounded "(neutral)" circuit conductor ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1117

5- 41 - (200-11): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line as indicated:
... grounded "(neutral)" conductor shall ...
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 210 -- BRANCH CIRCUITS

Log # 3

2- 2 - (Articles 210, 215, 220): Accept
Secretary's Note: The following proposal consists of Comment 2-4 on Proposal 2-2 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 2-2 was as follows:
NOTE: The word "approved" should be removed from every section where used in the NEC and replaced with the word "acceptable," where it does reference listing and labeling by a nationally recognized testing laboratory.
SUBMITTER: Joseph A. Tedesco, Weymouth, MA
RECOMMENDATION: Replace the word "Acceptable" in section 210-21(b)(4) with the word "permitted."
Revise the second sentence of Section 210-23 as follows:
"An individual branch circuit shall be permitted to supply any load for which it is rated."
Revise Section 220-2(c)(5), Exception No. 2 as follows:
Exception No. 2: Table 220-19 shall be permitted for computing the load of household electric range(s).
SUBSTANTIATION: The word "approved" is not used in the Articles assigned to Code Making Panel 2. The word "Acceptable" is used and should be removed and revised as I have recommended above.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 880

2- 4 - (210-2): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: In tabulation change title of Article 710 to "Medium- and High-Voltage Systems".
SUBSTANTIATION: For correlation with proposed change in title of Article 710.
PANEL ACTION: Accept.
PANEL COMMENT: The Panel accepts the proposal for correlation contingent upon the acceptance by Panel 13 of the related changes in Article 710.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 585

2- 5 - (210-3, Exception): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert:

"for nonlighting loads" between "amperes" and "shall".

SUBSTANTIATION: To correlate with Section 210-23(d).

PANEL ACTION: Accept in Principle.

Add "to supply nonlighting outlet loads" after

"permitted" in the exception to Section 210-3.

PANEL COMMENT: Editorial change to be consistent with Section 210-23(d).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 70

2- 6 - (210-4(a), Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 210-4(a), add:

Exception: Where used, handle ties shall not be installed to permit independent switch handle operation.

SUBSTANTIATION: The use of separate single-pole switches or breakers as multipole disconnects without proper "handle ties" on multiwire circuits (as in Sections 210-4 and 230-71(b)), for example, is at an epidemic level and:

1. The code does not adequately address the subject to emphasize the potential dangers involved when proper safeguards are not used (Section 230-71(b) touches on the subject).

2. These "multipole" devices are all too often, installed without "handle ties" and this: (a) makes it very difficult or impossible for the trouble-shooter or others to pin-point the missing "handle tie"; and (b) makes it difficult or utterly impossible to know which handles to turn off before attempting to work on the circuit.

The above conditions do pose a very serious safety hazard that could easily lead to a disabling or fatal shock for repair-persons or others.

3. The subject devices are very frequently installed where loose-fitting nails, wires or screws are used as substitutes for "handle ties" which allow independent operation of the poles of the switch/breaker; this is also a serious safety hazard that could lead to a crippling or deadly shock.

The ever-pressing need for "handle ties" is exemplified by the above.

Finally, the need for approval of this recommendation (Exception) is urgent.

PANEL ACTION: Reject.

PANEL COMMENT: As written, the proposal is unclear as to what the exception is an exception to. The substantiation does not support the need for simultaneous disconnection in Section 210-4(a) as presently required in Section 210-4(b). When simultaneous disconnection is required, it must be provided by an "approved" means, such as factory-provided handle ties, and not by the use of nails, etc.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1250

2- 7 - (210-4(b), FPN's-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 210-4(b), add 2 new FPN's as indicated:

"(FPN): If the handles of multiple individual circuit breakers for a circuit are improperly secured, undesirable/hazardous individual opening of the ungrounded conductors may occur."

"(FPN): The term ungrounded conductors as used in Section 210-4(b) also applies to ungrounded neutral conductors of ungrounded circuits/systems and other conductors where used as neutral conductors in ungrounded corner- center-tapped delta-connected transformer systems, for example."

SUBSTANTIATION: This FPN should be added because individual circuit breakers, where used, should be required to be installed in an approved manner to ensure that all ungrounded conductors are simultaneously opened and additionally this would provide a meaningful/effective reference for the enhancement of Code enforcement/compliance, especially for those cases that are frequently observed in the

field where such circuit breaker handles are loosely secured with undersized nails, screws or solid copper wires so as to allow individual opening of the ungrounded conductors of the circuit in violation of the applicable provisions/intent of Section 210-4(b).

The second (new) note should be added because, for reasons not clearly understood, a similar safety provision for 2-wire circuits was deleted from the 1984 NEC in Proposal 4-123-240-20(b) (over a panel member's objection). Nevertheless, the opening of ungrounded neutral conductors and other conductors, where used as neutral conductors, in ungrounded circuits/systems in accordance with the provisions of Section 210-4(b) is required because the hazardous voltage conditions that are common to "grounded circuits/systems" as indicated in Section 250-1(f), (FPN) may be present in the neutral and/or other conductors where used as neutral conductors in ungrounded circuits/systems.

As a reference, Section 250-1(f), (FPN) reads, in part, as follows: "Systems and circuit conductors are grounded to limit voltages due to lightning, line surges, or unintentional contact with higher voltage lines, and to stabilize the voltage to ground . . ."

Since any of the "voltage sources" listed in the above reference may charge/energize an ungrounded system and all of the circuits (including the neutral and other conductors where used as neutrals) of the system to very high levels of voltage, the possible consequences for not providing a means for opening all ungrounded conductors as indicated/intended in Section 210-4(b) and as expressed in this New (FPN) should become more apparent.

NOTE 1: See supporting material in enclosure #1 from Division 11, page 11 - 54, Section 63 of the American Electricians' Handbook, Ninth Edition, 1970.

NOTE 2: Applicable provisions of this proposal may/should also be considered for adoption elsewhere in this Code, if deemed necessary.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The proposed FPN's would create confusion instead of clarity. The requirements for the use of disconnecting means and branch-circuit overcurrent devices for multiwire circuits are covered in Section 210-4. Single-pole circuit breakers used in multiwire circuits should be listed for the purpose and should be provided with handle ties as specified by the circuit breaker manufacturer.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2475

2- 8 - (210-4(c), Exception No. 2): Reject

SUBMITTER: William Mieras, Grand Rapids, MI

RECOMMENDATION: Deleted text:

Exception No. 2. Where all ungrounded conductors of the multiwire branch circuit are opened simultaneously by the branch circuit over current device.

SUBSTANTIATION: While this part of the Code is safe and adequate when administered by qualified personell, the problem arises when home owners attempt to replace, remodel, or repair these outlets. On several occasions I have encountered where people have remodeled rooms wired with a common neutral, when replacing the outlets they have failed to remove the tabs on the hot side. The resulting short was severe enough to damage the bus bars. In another case the 2 pole breaker had been replaced with 2 single poles. By not allowing these circuits in the first place, we can eliminate a possible problem down the line.

PANEL ACTION: Reject.

PANEL COMMENT: Exception No. 2 applies only to Section 210-4(c), and the substantiation refers to Section 210-4(b). The Panel intends to permit line-to-line load under the conditions in Exception No. 2.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 9 - (210-4(d)-(New)): Accept

SUBMITTER: CMP 2

RECOMMENDATION: After the existing FPN, add a new Section 210-4(d):

210-4(d) Identification of Ungrounded Conductors. Where more than one nominal voltage system exists in a building, each ungrounded system conductor shall be identified by phase and system.

The means of identification shall be permanently posted at each branch-circuit panelboard.

(FPN): The means of identification of each system phase conductor, wherever accessible, may be by separate color coding, marking tape, tagging, or other equally effective means.

SUBSTANTIATION: Many proposals have been submitted in the past concerning identification of ungrounded conductors of different systems. These proposals have been rejected for various reasons. However the need for some form of identification is still there.

120/208-V and 277/480-V circuits are in common use in commercial buildings. In many cases these different voltage circuits are in the same conduit and or enclosure. For safety reasons a mandatory means of identification of these different circuits is needed. Choosing the wrong ungrounded conductor of these different systems is a common problem and can cause hazardous conditions. Electrically maintaining balancing of circuits would be much easier with proper identification of the ungrounded conductors.

The Safety Director for the I.B.E.W. recently indicated that from January 1, 1984 through December 31, 1986, ninety-four (94) I.B.E.W. members were killed by electrical shock. Between forty-four and fifty (44-50) of these were on 277 volts, usually where this voltage was not recognized. How many of these lives could have been saved if the circuits were properly identified?

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Hazzard, Rao, Vaughan.

EXPLANATION OF VOTE:

HAZZARD: This proposal will be difficult to enforce, especially after leases have been renovated. If ungrounded conductors are moved to balance loads it is doubtful conductors will be reidentified, thereby creating a greater hazard. If 210-5(a) (requiring the grounded conductor of branch circuits to be identified) was enforced it would better identify different systems and reduce the likelihood of connections to wrong grounded circuits.

RAO: Mandatory color coding of different voltage systems should not be a requirement especially when there are no universally established colors designated for each system phase conductor. It would be extremely difficult to establish and maintain or continue a color code on a conductor when going from an installed wire and conduit system to a manufactured wiring system or cord conductors. The substantiation states that approximately one half (1/2) of the deaths by electrical shock occurred on 277 volt systems and I, therefore, assume the other half occurred on 120 volt systems. If the 277V systems had been 120V systems, would the deaths by shock been reduced? The problem is not the voltage of the system, but rather the precautions that should be taken prior to working on any energized conductors.

VAUGHAN: Most of the commercial and industrial buildings are leased or rented by the occupants with varying time periods, making it necessary for frequent requirement changes to the single and three phase wiring systems, therefore, from a realistic standpoint we feel that the greatest safety can be achieved by using competent electrical technicians, verifying all identifications, in the initial electrical installations and the on going changes in new leases, requiring modifications in the wiring systems.

In many instances the new leases are inclined to utilize their own, (in some instances) incompetent technicians to make the necessary modifications, resulting in the creation of many hazardous conditions, therefore, real safety is in competent personnel NOT by further expansion of color identification systems.

Log # 1251

2- 10 - (210-4(d)-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After 210-4(c), Exception No. 2, (FPN), add as indicated:

"210-4(d) Grounded Conductors. No switch/overcurrent device shall be connected in series with any conductor that is intentionally grounded except where specifically required/permitted by this Code."

Submitted material has been reproduced as received.
See note on Page 1.

SUBSTANTIATION: For reasons of safety, this change should be made to ensure compliance with the applicable provisions of Section 230-90(b), 240-22, Exception No 1 and 380-2(b), Exception No 1 and 2 and also to allay the chance of misunderstanding/misapplication in regards to switch/overcurrent device requirements because of the differences between Section 230-90(b), 240-22, Exception No 1 and 2 and 380-2(b), Exception No 1 and 2 and the requirements specified in Section 430-36 and 514-5.

PANEL ACTION: Reject.

PANEL COMMENT: The installation of overcurrent devices in series with grounded conductors is already covered in Section 240-22, and is unnecessary to repeat here. Switches are covered in Section 380-2(b).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3372

2- 11 - (210-4(d)-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 210-4(c), (FPN), add new Section as indicated:

"(d) Neutral Requirements-Multiwire Circuits. Where two or more ungrounded conductors of a multiwire circuit supplying line to neutral load is protected by circuit breaker poles with common polarity (poles connected to the same supply bus/terminal) each such conductor shall have a grounded (neutral) conductor sized in accordance with the applicable provisions of Article 220."

SUBSTANTIATION: The use of "common" (and often undersized) neutral conductors with circuits protected by circuit breakers with 1-line side and 2-loadside terminals with common polarity or 2-line side terminals where each line side terminal supplies 2-load side terminals with common polarity may cause dangerous overloading of such neutral conductors where the neutral conductor is undersized.

This undersized neutral condition is not always readily apparent to the Inspector and, additionally, the Code does not provide adequate guidelines for the proper sizing of neutral/common neutral conductors in such cases.

The problems that are outlined herein are observed with disturbing regularity in the field.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not comply with the definition of multiwire circuit. These are not multiwire circuits with 2 or more ungrounded circuit conductors with potential between them. These are 2 separate branch circuits and should have separate grounded circuit conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1118

2- 12 - (210-5(a) and Exception No. 1): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend as indicated:

210-5(a), first line in the first sentence:

... grounded "(neutral)" conductor of ...

210-5(a), third line in the second sentence:

... system grounded "(neutral)" conductor ...

210-5(a), second line in the third sentence:

... grounded "(neutral)" conductor ...

Exception No. 1, first line:

... grounded "(neutral)" conductor of ...

SUBSTANTIATION: This change is needed to more adequately clarify and simplify the Code meaning/intent because, in accordance with this Code, the neutral and the grounded conductor performs the same/similar functions as indicated in Sections 230-31(c) and 230-42(c). Also, this would do much to minimize confusion and misapplication because in some Code sections the term "neutral" is used and in other sections the term "grounded conductor" is used; for example, in Section 200-2 "grounded conductor" is used and in Section 210-4 "neutral" is used.

PANEL ACTION: Reject.

PANEL COMMENT: The neutral is not always a grounded conductor. Neither is the grounded conductor always a neutral. The word "neutral" is appropriate in Section 210-4 as it carries the unbalanced currents.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2561
2- 13 - (210-5(c)-(New)): Accept in Principle
SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors
RECOMMENDATION: Add a new Section 210-5(c) to read as follows:

UNGROUNDING CONDUCTORS

- 1) Ungrounded conductors of multi-wire branch circuits, (3 wire & 4 wire) which are associated with a grounded neutral branch circuit conductor shall be identified.
- 2) Different identification shall be used for different systems.
- 3) The same identification shall be used for each phase conductor throughout the system.
(FPN) the means of identification could be using different conductor colors for all circuits of the same voltage, marking tape or conductor tags for all circuits of the same voltage where the conductor is accessible.
- 4) The means of identification shall be permanently posted at the main service disconnect or distribution.

SUBSTANTIATION: Many proposals have been submitted in the past concerning identification of ungrounded conductors of different systems. These proposals have been rejected for various reasons. However the need for some form of identification is still there.

120/208V and 277/480V circuits are in common use in commercial buildings. In many cases these different voltage circuits are in the same conduit and or enclosure. For safety reasons a mandatory means of identification of these different circuits is needed. Choosing the wrong ungrounded conductor of these different systems is a common problem and can cause hazardous conditions. Electrically maintaining balancing of circuits would be much easier with proper identification of the ungrounded conductors.

The Safety Director for the I.B.E.W. recently indicated that from January 1, 1984 through December 31, 1986, ninety four (94) I.B.E.W. members were killed by electrical shock. Between forty four and fifty (44-50) of these were on 277 volts, usually where this voltage was not recognized. How many of these lives could have been saved if the circuits were properly identified?

PANEL ACTION: Accept in Principle.

PANEL COMMENT: All the submitter's concerns have been included by the Panel Action in Proposal 2-9 to Section 210-4(d)-(New). The Panel agrees with the substantiation.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Vaughan.

EXPLANATION OF VOTE:

RAO: See comment on Proposal 2-9.

VAUGHAN: Same as in Proposal 2-9.

PANEL COMMENT: The Panel accepted the intent of the first paragraph by accepting Proposal 2-9.

The exception is rejected because the Panel believes that current-carrying conductors in a multiwire branch circuit should be identified even if in a separate raceway.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Vaughan.

EXPLANATION OF VOTE:

RAO: See comment on Proposal 2-9.

VAUGHAN: Same as in Proposal 2-9.

Log # 1384

2- 15 - (210-5(c)-(New)): Reject
SUBMITTER: James H. Richards, Middle Department Inspection Agency, Inc.

RECOMMENDATION: Add:

UNGROUNDING CONDUCTORS (1) Ungrounded conductors of multi-wire branch circuits (3 wire & 4 wire) which are associated with a grounded neutral branch circuit conductor shall be identified by different colors for each ungrounded phase conductor throughout their length.

(2) Different colors shall be used for different systems

(3) The same color shall be used for each phase conductor throughout the system.

SUBSTANTIATION: With the more frequent use of 120/208 and 277/480 volt wye connected systems in a single occupancy, building or structure it becomes a very important safety factor to properly identify each system throughout the occupancy. Metallic cable and non-metallic cable manufacturers have continued to observe color coded conductors and drawn in wiring can be easily identified. I have checked with many suppliers and find that #14 #12 & #10 conductors in both solid and stranded conductors are readily available. Not only are the un-identified systems a hazard to persons working them but are also a danger to equipment being connected to them.

THE CODE SHOULD THINK MORE ABOUT THE SAFETY OF PERSONS AND EQUIPMENT AND LESS ABOUT THE ECONOMY OF STOCKING THE MATERIALS REQUIRED TO MAINTAIN THAT SAFETY FACTOR. There is and never was a need to identify straight three phase conductors used for motor or other branch circuits where a grounded neutral is not a part of the circuit.

Some of the arguments against this proposal show a lack of understanding of what is asked.

PANEL ACTION: Reject.

PANEL COMMENT: Identification by other means was accepted. See Proposal 2-9.

The Panel believes that other means, such as tagging or tapes, are as acceptable as color coding.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1752

2- 14 - (210-5(c)-(New) and Exception-(New)): Accept in Principle

SUBMITTER: George B. Wiggin, Lusby, MD

RECOMMENDATION: Add:

210-5(c) Phase conductors multiwire circuit. Each phase conductor shall have a distinctive marking either by color, taping or tagging.

Exception No. 1: Conduits, raceways, or cables containing only one set of multiwire circuit conductors shall not be required to have the phase conductors identified.

SUBSTANTIATION: Where several sets of multiwire circuit conductors are run in one raceway or conduit and there is no identification of the individual phase conductors there is no way to visually assure the installer or an inspector that each phase conductor of the multiwire circuit is connected to a different phase. Failure to install the conductors as a multiwire circuit is not only a Code violation by definition but can also result in over heating and failure of the neutral or grounded conductor.

PANEL ACTION: Accept in Principle.

Log # 1215

2- 16 - (210-5(c)-(New)): Reject

SUBMITTER: Herbert S. Pharo, Alliance Electric

RECOMMENDATION: Add:

210-5(c) Ungrounded conductors. Ungrounded conductors of different voltages shall be permitted to be of different color or identified by other means.

(FPN) A suggested method of identifying ungrounded conductors is as follows: for systems under 250 volts black, red & blue. Systems 251 volts up to 600 volts, brown, orange, and yellow.

SUBSTANTIATION: To set color code standard, one that is acceptable to all, but not necessarily enforceable.

PANEL ACTION: Reject.

PANEL COMMENT: Identification should be required and for multiwire branch circuits only.

The FPN is rejected because means of identification other than color is acceptable. See Proposal 2-9. Orange is already the identification used in Section 215-8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2160

2- 17 - (210-5(c)-(New)): Reject

SUBMITTER: Gilbert L. Thompson, Baltimore County
Electrical Inspection Division

RECOMMENDATION: Add a new Section 210-5(c) to read as follows:

"Ungrounded Conductors. Where installed in raceways, wireways, cables, as open work, or as concealed knob and tube work, the ungrounded conductors of 15, 20, and 30 ampere capacity shall be identified throughout their length by any colors other than those specified in (a) and (b) above. All ungrounded conductors of the same color shall be connected to the same ungrounded feeder conductor and conductors for systems of different voltage shall be of different colors. When making additions to wiring in existing buildings having a specific color code and identification, the additional work shall use the same color or identification as previously used.

Exception: This rule shall not apply to motors or their control circuits, or other sections of this Code that specifically specify colors.

SUBSTANTIATION: In many modern buildings systems are used having different voltages or frequencies such as (120/240)(120/208)(277/480) or DC, etc. Since it is permitted to run any or all of these in a single wireway, conduit or other enclosure it is of vital interest to safety of these systems, as well as to the persons working on them that the conductors of these different systems be permanently and distinctively identified. According to some records compiled by organized labor, 94 electrocutions of their people occurred between 1984 and 1986. Since there is no accurate record of other fatalities, we can only assume the total is much higher. Anything which will further safety and protection should be considered.

PANEL ACTION: Reject.

PANEL COMMENT: Means of identification, other than color, is acceptable.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2176

2- 18 - (210-5(c)-(New)): Reject

SUBMITTER: Leonard L. Johnson, Baltimore, MD
RECOMMENDATION: Add:

(c) Ungrounded Conductors. Multiwire circuits installed in raceways shall have the different phases of the ungrounded conductors identified by different colors along their entire length. Different voltages shall be of different colors. The same color shall be used for each phase throughout the system.

Exception: Conductors larger than No. 10 shall not be required to carry the color, along their entire length but shall be required to be identified at terminations.

SUBSTANTIATION: When several multiwire branch circuits are installed in the same raceway it becomes very difficult to assure the neutral is only carrying the unbalanced load.

PANEL ACTION: Reject.

PANEL COMMENT: Means of identification, other than color, is acceptable.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2222

2- 19 - (210-5(c)-(New)): Accept in Principle
SUBMITTER: Richard Ericson and William Swanson,
I.B.E.W. Eastern Code Advisory Group

RECOMMENDATION: Add a new Section 210-5(c) to read as follows:

UNGROUNDING CONDUCTORS

1) Ungrounded conductors of multi-wire branch circuits (3 wire & 4 wire) which are associated with a grounded neutral branch circuit conductor shall be identified.

2) Different identification shall be used for different systems.

3) The same identification shall be used for each phase conductor throughout the system.

4) The means of identification shall be permanently posted at the main service disconnect or distribution.

(FPN) the means of identification could be using different conductor colors for all circuits of the same voltage, marking tape or conductor tags for all circuits of the same voltage where the conductor is accessible.

SUBSTANTIATION: Many proposals have been submitted in the past concerning identification of ungrounded conductors of different systems. These proposals have been rejected for various reasons. However, the need for some form of identification is still there.

208/120V and 480/277V circuits are in common use in commercial buildings. In many cases these different voltage circuits are in the same conduit and/or enclosure. For safety reasons a mandatory means of identification of these different circuits is needed. Choosing the wrong ungrounded conductor of these different systems is a common problem and can cause hazardous conditions. Electrically maintaining balancing of circuits would be much easier with proper identification of the ungrounded conductors.

The Safety Director for the I.B.E.W. recently indicated (see attached) that from January 1, 1984 through December 31, 1986, ninety four (94) I.B.E.W. members were killed by electrical shock. Between forty four and fifty (44-50) of these were on 277 volts, usually where this voltage was not recognized. How many of these lives could have been saved if the circuits were properly identified?

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See CMP Proposal 2-9 to Section 210-4(d) where the submitter's intent has been addressed. The Panel agrees with the substantiation.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Vaughan.

EXPLANATION OF VOTE:

RAO: See comment on Proposal 2-9.

VAUGHAN: Same as in Proposal 2-9.

Log # 2324

2- 20 - (210-5(c)-(New)): Reject

SUBMITTER: Geoffrey Dolan, Olympia Fields, IL
RECOMMENDATION: New text:

Whenever a premises wiring system consists of both 480/277V & 208/120V circuits color coding of ungrounded conductors shall be as follows

Brown Orange Yellow for 480V conductors

Black Red Blue for 208V conductors

SUBSTANTIATION: The above proposal has pretty much become the unwritten standard of the industry. Very often the above color code is employed on a job until nearly the end when the contractor may run out of one or more colors. Because there is nothing in the Code mandating the use of the color code the foreman can instruct his employees to mix colors. I feel this is a dangerous practice because people who maintain the wiring in the future come to trust the color code to tell them the voltage of a circuit.

I realize that my proposal, as written, would create inconsistencies in other parts of the Code. It is my hope that this is one of many letters addressing this problem and that someone else did their homework a little better than me.

PANEL ACTION: Reject.

PANEL COMMENT: Means of identification, other than color, is acceptable. Orange is the identification used in Section 215-8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2337

2- 21 - (210-5(c)-(New)): Reject

SUBMITTER: Edward J. Coppinger, Jr., Voorhees, NJ
RECOMMENDATION: New text:

Ungrounded Conductors.

The ungrounded conductors installed in raceways & wireways of multiwire branch circuits may be identified by a continuous predetermined color. Where 120v/208v and 277v/480v 3 phase systems are utilized in the same building. The color code may be as follows:

120v/208v 3 phase 277v/480 3 phase
 A phase Black A phase Brown
 B phase Red B phase Orange
 C phase Blue C phase Yellow
 Grounded Conductor - White Grounded Conductor - Gray

SUBSTANTIATION: In your modern and newly renovated electrical systems we are experiencing two or more wiring systems. To promote a color code standard on ungrounded conductors would make it easier to distinguish between these systems. The Code goes to great lengths to distinguish between grounded conductors as to not confuse these conductors with other systems but leaves ungrounded conductors to chance. If the Code is going to distinguish system grounded conductors then why not the ungrounded conductors.

PANEL ACTION: Reject.

PANEL COMMENT: Means of identification, other than color, is acceptable. Orange is the identification used in Section 215-8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2706

2- 22 - (210-5(c)-(New)): Reject
SUBMITTER: Robert M. Milatovich, Inspection Division, City of Fresno, CA.

RECOMMENDATION: New text:

Multiwire branch circuits of voltages 208Y/120 - 480Y/277 shall be identified by a continuous predetermined color as follows:

	"A" Phase	"B" Phase	"C" Phase	Ground Conductor
120/240 Volt 1-Phase 3-wire	black	red	---	white
120/240 Volt 3-Phase 4-wire	black	red	blue	white
208Y/120 Volt 3-Phase 4-wire	black	red	blue	white
480Y/277 Volt 3-Phase 4-wire	brown	orange	yellow	gray
240/480 Volt 3-Phase 4-wire	brown	orange	yellow	gray

SUBSTANTIATION: By creating a standardized color code we will provide safer installations by maintaining correct circuit phasing.

PANEL ACTION: Reject.

PANEL COMMENT: Means of identification, other than color, is acceptable. Orange is the identification used in Section 215-8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2820

2- 23 - (210-5(c)-(New)): Reject
SUBMITTER: James D. Kraemer, A.C. Scott Electric Co., Inc.

RECOMMENDATION: Add new section 210-5(c) to read as follows:

Branch Circuits intended for 277 volt lighting shall be identified by the following color code, brown, orange and yellow for ungrounded conductors, and gray for the grounded conductor.

SUBSTANTIATION: There has been a substantial loss of life to electrical workers working on 277 volt lighting, between Jan. 1, 1984 through Dec. 31, 1986 the International Brotherhood of Electrical Workers reported that approximately 50 members were killed by electrical shock on 277 volts. This occurred usually where this voltage was not recognized.

In some areas of the country this color code is in fact the industry standard, the National Electrical Code should come up to this standard.

Some areas already mandate a color code by local or state regulation (I.E. Massachusetts Electrical Code.)

The color code system has been in previous Codes, and worked well for not only safety reasons, but also in balancing multi-circuit loads at branch circuit panels.

PANEL ACTION: Reject.

PANEL COMMENT: Means of identification, other than color, is acceptable. Orange is the identification used in Section 215-8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 682

2- 24 - (210-6(a)(2)): Accept in Principle
SUBMITTER: Joseph S. Dador, Midway City, CA

RECOMMENDATION: Revise to read:

Cord- and plug-connected loads of "1440" volt-amperes "or less", nominal "or 1/4 horsepower or less".

Note: Added material in quotations.

SUBSTANTIATION: Two problems in the existing section are solved by this proposal. The first one was created, when in the 1984 NEC, the nominal voltage used in all calculations was changed from 115 V to 120 V. The 1380 VA historically came from a 12 A load at 115V, but when Section 220-1 was changed in 1984, the value given in Section 210-6(c) (1984) was not corrected. This error was carried over to the 1987 revision to this entire Section, where the value is now stated in Section 210-6(a). The revision proposed here would continue the past practice of requiring all loads 12 A or less in dwelling unit and similar occupancies to be required to be on 120 V circuits.

The second problem addressed is the removal of the permission to place motor loads greater than 1/4 horsepower on 208 V or 240 V circuits in dwelling units and similar occupancies. The present wording now requires all 1/3 and 1/2 horsepower motors (which have loads greater than 1/4 horsepower, but less than 1380 VA) in these occupancies to be supplied from 120 V circuits. There was no justification presented in the documentation justifying this change in requirements, which dates back to at least the 1962 NEC (the oldest copy in my possession).

PANEL ACTION: Accept in Principle.

Change to read:

"Cord- and plug-connected loads 1440 volt-amperes, nominal, or less, or less than 1/4 horsepower."

PANEL COMMENT: To allow the 1/4 horsepower motor to be used at either 120 volts or higher.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2387

2- 25 - (210-6(b)(2), 210-6(c)(2)): Reject
SUBMITTER: Ernest M. Freegard, Advance Transformer Co.

RECOMMENDATION: Delete para. 210-6(b)(2) and replace with the following:

(2) Ballasts of electric discharge lamp lighting fixtures equipped with either medium-base or mogul-base screw shell lampholders

Delete para 210-6(c)(2) and replace with the following:

(2) Ballasts of electric discharge lamp lighting fixtures equipped with either medium-base or mogul-base screw shell lampholders

SUBSTANTIATION: The voltage delivered to the screw-shell lampholder in electric discharge lighting fixtures, whether medium or mogul base, is NOT determined by the branch circuit voltage. The AUXILIARY EQUIPMENT OF ELECTRIC DISCHARGE LAMPS (the ballast) is supplied by the branch circuit voltage. The branch circuit voltage is the INPUT to the ballast and may be 120, 208, 240, 277, or 480 volts. It is the OUTPUT of the ballast that is supplied to the lampholder to operate the discharge lamp, and for any given lamp type this is constant regardless of the branch circuit voltage. For instance, 50 watt and 75 watt mercury lamps, which are available only with medium-screw bases, require that the ballast deliver 250 volts at the lampholder in order to start and operate the lamps. Ballasts must provide this 250 output volts regardless of whether the input (branch circuit) voltage is 120, 277 or anything else.

Para 210-6(c)(2) of the 1987 NEC SPECIFICALLY PERMITS 277 volt branch circuits to supply auxiliary equipment of electric discharge lamps. However, problems have arisen because widely distributed INTERPRETATIONS of the 1987 Code have indicated just the opposite, that

such use is not permitted. "The National Electric Code Handbook" (Schram pp 67-68) and "The Analysis of the 1987 NEC" (Summers pp 16-17) both indicate that medium base screw-shell lampholders are not permitted on 277 volt branch circuits. It is difficult to understand how these interpretations can follow from the specific language in the Code.

Several electric discharge lamps are available only with medium screw bases. For example, the 35 watt high pressure sodium lamp, the 100 watt metal halide lamp and several mercury vapor lamps including the 50 watt and 75 watt types are not and never have been available with mogul screw bases. These lamps and ballasts have been widely used on 277 volt branch circuits for as long as twenty years with no known problems. Ballasts and lighting fixtures for such applications are UL listed or otherwise recognized.

We believe that the revision proposed above, while not a change in the intent of the Code, will resolve the problem caused by the misinterpretations.

PANEL ACTION: Reject.

PANEL COMMENT: The proposed Section 210-6(b)(2) would eliminate the use of fluorescent fixtures at 120 volts.

The proposed wording to Section 210-6(c)(2) excludes other than screw-shell type. See Proposal 2-27.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 586

2- 26 - (210-6(b)(3), (c)(3), (d)(2)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add: "including lighting in conformance with (1) or (2) above" after (b)(3) and (c)(3);

Add: "including lighting in conformance with (1) above" after (d)(2).

SUBSTANTIATION: Utilization equipment as defined in Article 100 includes lighting and since the conditions of (b) (c) and (d) stand alone this word could be construed as in conflict with the requirements for lighting.

PANEL ACTION: Reject.

PANEL COMMENT: The Code is clear that (1), (2) and (3) apply.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2634

2- 27 - (210-6(c)): Accept

SUBMITTER: Theodor G. Yahraus, Lithonia/Hi-Tek Lighting

RECOMMENDATION: 210-6. Branch Circuit Voltage Limitations

Under item 210-6(c) 277 Volts to Ground, redesignate subsection (2) as subsection (4), and, subsection (3) as subsection (5). Allowing for the renumbering, establish the following three new subsections:

(1) Listed electric discharge lighting fixtures equipped with medium-base screw shell lampholder.

(2) Lighting fixtures equipped with mogul-base screw shell lampholders.

(3) Lampholders other than the screw-shell type applied within their voltage ratings.

SUBSTANTIATION: 1. The voltage delivered to the screw-shell lampholder in electric discharge lighting fixtures, whether medium-based or mogul-based, is NOT dependent upon the branch circuit voltage. The AUXILIARY EQUIPMENT OF ELECTRIC DISCHARGE LAMPS (i.e. the ballast) is supplied by the branch circuit, which is considered as INPUT to the ballast, and may be 120, 208, 240, 277 volts. The OUTPUT of the ballast is the voltage delivered to the lampholder -- and that is a constant regardless of the INPUT voltage of the branch circuit. To repeat, the voltage at the lampholder of an electric discharge lighting fixture is the SAME REGARDLESS WHETHER THE BRANCH CIRCUIT IS 120 or 277 VOLTS!

In response to the Code Panel's expressed concerns for safety, the major lamp and ballast manufacturers reviewed their product records to determine if there were any confirmed reports concerning the improper insertion of a 120 volt incandescent lamp into medium-based ELECTRIC DISCHARGE screw-shell lampholders. THERE WERE NO REPORTS OF INJURY OR

VIOLENT ERUPTION OF LAMPS. Further, lamp and ballast companies have conducted tests on their own to determine if a 120 volt incandescent lamp inserted into an electric discharge lighting fixture connected to a 277 volt branch circuit resulted in a rupture of the lamp. THERE WERE NO SUCH CASES REPORTED.

3. Most interpretations of the 1984 National Electric Code permitted use of either medium- or mogul-based screw shell lampholders in CONJUNCTION WITH auxiliary equipment of electric discharge lighting fixtures. It has long been clear that if there were safety concerns, they were focused on incandescent screw-shell base holders directly connected to branch circuits with voltages in excess of 120 volts. There has been NO substantiation for any safety concern involving medium-based screw-shell lampholders properly incorporated into an electric discharge lighting fixture.

Current problems have arisen from differing interpretations brought about by the lack of clarity of 210-6(c). Underwriters Laboratories continues to list electric discharge lighting fixtures designed to be connected to branch circuits in excess of 120 volts. Three nationally recognized commentators differ on their interpretation of the Code. The lighting industry and some electrical inspectors maintain that the existing Code language allows medium-based screw shell applications for electric discharge fixture applications. "The National Electrical Code Handbook" (Schram pp 67-68), and "The Analysis of the 1987 NEC" (Summers pp 16-17) indicate all medium-based screw shell lampholders are prohibited when connected to branch circuits in voltages in excess of 120 volts. Other commentators express different views.

4. Medium-based mercury vapor lighting (using 50, 75 and 100 watt lamps) has been widely used throughout the United States since the 1950s. These electric discharge fixtures have been safely connected to branch circuits other than 120 volts without any safety problems arising. Today there are tens-of-thousands of medium-based electric discharge lighting fixtures listed and in use throughout the country. The 35 watt high pressure sodium, the 100 watt metal halide, and several mercury vapor lamps, including the 50 and 75 watt lamps, HAVE NEVER BEEN MANUFACTURED IN ANY FORM OTHER THAN MEDIUM-BASE.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2158

2- 28 - (210-6(c)): Reject

SUBMITTER: Gilbert L. Thompson, Baltimore County Electrical Inspection Division

RECOMMENDATION: Revise the wording of Part (1) to read as follows:

(1) Lighting fixtures equipped with mogul-base screw-shell lampholders or with lampholders other than the screw-shell type applied within their voltage ratings or to auxiliary equipment of electric discharge lamps. The fixture of auxiliary equipment shall be mounted not less than 8 feet (2.44 m) from the floor or grade unless warning labels and tamperproof means are provided to keep unauthorized persons from servicing this equipment. Integral lighting switches, if used, shall not be readily accessible. Delete Part (2) and renumber existing Part (3) so that it will become Part (2).

SUBSTANTIATION: At the last Code change cycle, there were proposals to provide restrictions on the fixtures and their locations when operating at over 120 volts because of the danger that exists when other than authorized persons have access to the fixtures and integral switches. There have been some injuries sustained by unauthorized people having access to and servicing these type fixtures and switches. Fixtures operating at over 120 volts should be labeled with a warning that only authorized persons should service the equipment, and means other than ordinary slotted screws, wing nuts, or tension type clasps should be used. This would provide the means of safety to ensure that this type voltage is guarded from easy access to other than persons familiar with the construction and operation of the equipment and the hazards involved.

Switching should be controlled also through equipment listed and labeled for the purpose and located so as not to present a shock hazard.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not want to limit the height of the fixture or auxiliary equipment to over 8 feet. There is not sufficient substantiation for such restriction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2511

2- 29 - (210-6(c)): Reject

SUBMITTER: Dave Thrasher, Greiner, Inc.

RECOMMENDATION: Add paragraph as follows:

(4) Electric-discharge lampholders of the screw shell type, if used shall be mounted not less than 8 feet (2.44m) from floor or finished grade.

SUBSTANTIATION: Allowing 277V bollards is hazardous and should be prohibited. Let's get back to the 1984 N.E.C. restriction.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not want to limit the height of the fixture or auxiliary equipment to over 8 feet. There is not sufficient substantiation for such restriction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2965

2- 30 - (210-6(c)(1)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Add the words "admedium or" before the words "mogul-base screw-shell".

SUBSTANTIATION: Admedium based lampholders, being unusable with conventional medium based lamps, present no additional safety hazard over mogul bases and should be recognized here in addition to the mogul-based lampholders.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation is given for including admedium. There is no substantiation that the admedium would be safe.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3419

2- 31 - (210-6(c)(1), Exception-(New)): Reject

SUBMITTER: Bernard J. Mezger, American Home Lighting Institute

RECOMMENDATION: Add the following to this section:

Exception: Lighting fixtures equipped with medium-base screw-shell lampholders may be supplied in circuits protected by overcurrent devices rated or set at no more than 15A.

SUBSTANTIATION: It is reported that there are many medium based screw-shell lampholders being supplied in 277 volt circuits without problems. The proposal is to allow their continued use in low wattage circuits by adding overcurrent protection.

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent that medium-base screw-shell lampholders not be directly connected to 277-volt branch circuits. Limiting the overcurrent protection to 15 amperes would not make a 277-volt branch circuit less hazardous.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2304

2- 32 - (210-6(c)(2)): Accept in Principle

SUBMITTER: Darl E. Billingsley, Holophane Division Manville Corp.

RECOMMENDATION: Delete present Paragraph 210-6(c)(2) and replace with the following new paragraph:

210.6(c)(2) Auxiliary Equipment of Electric Discharge Lamps used with medium base or mogul base screw shell lamp holders or lampholders of other types applied within their voltage ratings.

SUBSTANTIATION: Prohibiting use of a medium base screw shell lampholder on branch circuits exceeding 120V, nominal to ground (for HID lighting equipment) is a meaningless requirement. Many HID lighting equipment circuits effectively isolate the lampholder from the branch circuit conductors and in any case the voltage across the lampholder is the same regardless of the branch circuit voltage. The voltage required to operate a HID lamp is dictated by that lamp and supplied by the auxiliary equipment for Electric Discharge Lamps.

Therefore, if 120V. branch circuits are considered safe and acceptable (for primary power to HID auxiliary equipment provided with medium base lampholders) then 208V. through 480V. are equally safe and acceptable.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel Action on Proposal 2-27 has clarified that medium-base lampholders are acceptable. Mogul-base and other types are covered under new Sections 210-63(c)(2) and (3).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 881

2- 33 - (210-6(e)-(New)): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Add:

(e) 1000 Volts Between Conductors. Branch circuits not exceeding 600 volts, nominal, to ground and not exceeding 1000 volts, nominal, between conductors shall be permitted to supply individual pump motors and related circuits where such circuits are properly grounded and are the only circuits fed from the service equipment.

SUBSTANTIATION: This proposal fills the gap between 600 volts, the proposed upper limit of "low-voltage" (See proposed definition of low-voltage circuits, equipment, and systems for addition to Article 100.) and recognizes the current practice in oil fields as outlined in ANSI/IEEE 464-1981, Recommended Practice for Grounded 830V Three-Phase Electrical System for Oil Field Service.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is being made to include a voltage limitation in Section 210-6, Branch Circuit Voltage Limitation. There are presently no specific voltage limitations in Section 210-6 for branch circuits above 600 V, and the proposal provides no justification for including such limitations.

The branch circuits to supply these motors are presently permitted.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Reign.

EXPLANATION OF VOTE:

REIGN: Grounded 830 volt, three phase, systems are currently being used by chemical companies for deep well pumping and in oil field applications as outlined by ANSI/IEEE 464-1981 "Recommended Practice For Grounded 830 V Three-Phase Electrical System For Oil Field Service". Branch circuits not exceeding 600 V to ground and not exceeding 1000 V between conductors should be recognized and included in the Code as recommended by the Correlating Committee's Ad Hoc Subcommittee on Voltages.

Log # 2190

2- 34 - (210-7(d), Exception): Accept in Principle

Secretary's Note: The Correlating Committee directs that CMP 2 follow the NEC Style Manual as it relates to the word "when". This action will be considered by the Panel as a Public Comment.

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.

RECOMMENDATION: Add new sentence to end of Exception as follows:

"Existing nongrounding type receptacles may be replaced with grounding-type receptacles when supplied through the ground-fault circuit-interrupter-type receptacle."

SUBSTANTIATION: This exception presently permits a GFCI receptacle to feed existing receptacles provided no ground wires are connected. But does it permit a two-wire receptacle to be changed to a three-wire receptacle? If the GFCI is permitted to supply downstream receptacles then why not provide the safety of using a three-wire cord-cap. The alternative is to cut the grounding terminal off in order to plug into the old two-wire device, then when used somewhere else there is no ground protection. Even if the equipment has a two wire cord-cap it cannot be plugged into a two-wire receptacle as the Code now requires all two-wire cord-caps to be polarized. The three-wire receptacles will be ungrounded, but the protection of the GFCI is still there. Let's clear this up.

PANEL ACTION: Accept in Principle.

Change "may" to "shall be permitted to".

PANEL COMMENT: Editorial to comply with NEC Style Manual.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1531

2- 35 - (210-7(d), Exception): Reject

SUBMITTER: LaVerne E. Stetson, Gerald R. Rodman, U.S. Department of Agriculture and University of Nebraska
RECOMMENDATION: ADD TO EXCEPTION.

Receptacle replacements downstream from a GFCI receptacle may be of the grounding or non-grounding type but must be labeled "GFCI protected."

SUBSTANTIATION: The exception does not indicate what receptacles can be fed with the GFCI device. The GFCI device itself is of the grounding type but where permitted by this exception will not be grounded. Grounding type receptacles downstream would have the same personnel protection as the device itself. Permitting grounding receptacles would allow grounding plugs to be used without adapters (cheaters). This assures better maintenance of polarity and permits use of better grades of receptacles. Ungrounded receptacles are made with fewer choices of quality. All outlets served by the device would have improved safety. Article 215-9 permits a GFCI device to protect a feeder which may be an old circuit without equipment grounding.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes labeling is unnecessary and would not add to safety.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1195

2- 36 - (210-8): Reject

SUBMITTER: Jack Wells, Pass & Seymour, Incorporated
RECOMMENDATION: Revise section 210-8 as follows:

210-8 Ground-Fault Circuit-Interrupter Protection for Personnel.

(A) General

(1) All 125-volt, Single-Phase, 15- and 20-ampere receptacles installed in bathrooms shall have ground-fault circuit-interrupter protection for personnel.

(2) All 125-volt, Single-Phase, 15- and 20-ampere receptacles installed outdoors where there is direct grade level access to the receptacles shall have ground-fault circuit-interrupter protection for personnel.

(FPN): See section 215-9 for feeder protection for the purposes of this section, "Direct Grade Level Access" is defined as being located no more than 6 feet, 6 inches (1.98 m) above grade level and being readily accessible without entering or passing through a building.

(3) Bathroom: As used in Section 210-8(a)(1), a bathroom is an area including a basin with one or more of the following: a toilet, a tub, or a shower.

(B) Dwelling Units

(1) All 125-volt, single-phase, 15- or 20-ampere receptacles installed in garages shall have ground-fault circuit-interrupter protection for personnel.

Exception No. 1: Receptacles which are not readily accessible.

Exception No. 2: Receptacles for appliances occupying dedicated space which are cord- and plug-connected in accordance with Section 400-7(a)(6), (a)(7), or (a)(8).

Receptacles installed under exceptions to Section 210-8(b)(1) shall not be considered as meeting the requirements of Section 210-52(f).

(2) At least one 125-volt, single-phase, 15- or 20-ampere receptacle installed in a basement shall have ground-fault circuit-interrupter protection for personnel and it shall be so identified.

(3) All 125-volt, single-phase, 15- or 20-ampere receptacles required by Section 210-52(b) installed within 6 feet (1.83) of the kitchen sink above counter top surfaces shall have ground-fault circuit-interrupter protection for personnel.

(4) All 125-volt, single-phase, 15- and 20-ampere receptacles installed in boathouses shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: This proposal will require bathroom receptacles to be GFCI regardless of the type of building or structure. Deletion of existing 210-8(b) hotels and motels does not exempt them from the GFCI requirement for the general requirement proposed would cover that application as well as public bathrooms in hotels, motels, offices, factories, campsites, airports, service stations, etc.

This proposal recognizes that the same grooming activities and the associated appliances are used by employees in factory or office bathrooms, travelers in airports, community baths in campsites, changing rooms in parks, etc.

Many such facilities already recognize the hazard and provide the GFCI protection. Accident statistics clearly demonstrate that improper use of hand held hairdryers in a bathroom is a leading cause of electrocution. Therefore, application of GFCI protection to all bathroom receptacles is both logical and necessary to reduce such accidents.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation refers only to bathrooms and does not correlate with the proposal which refers to all outdoor receptacles. There is no substantiation to include nondwellings.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2663

2- 37 - (210-8): Reject

SUBMITTER: Patricia B. Horton, Allied Tube & Conduit Corporation

RECOMMENDATION: Change after Bathroom: As used in Section 210-8, a bathroom is an area containing a basin for personal care, a tub, or a shower.

SUBSTANTIATION: There are many designs for a bathroom, not necessarily containing two of the items currently mentioned in the Code.

Some "bathrooms" have a room (with a door) containing a toilet only. Others have a basin and vanity outside of a room (with a door) which contains perhaps a toilet and tub or shower. A basin vanity only may be installed in a basement. I have seen bedrooms (where the toilet and bath are all in the hall) which contain personal care basin vanities. It is important that all basin locations having receptacles be protected. Showers and tubs, whether or not located contingent to the basin, should also have protection if a receptacle is located in that area because people do stupid things with electrical appliances, and many times are unaware there is a danger. I know this has been discussed before, but believe this clarifies the intent.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal could limit a bathroom to contain a basin only, a tub only or a shower only. This would make every basin in the house a bathroom which is not the Panel's intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1659
2- 38 - (210-8(a)(1), Exception-(New)): Reject
SUBMITTER: Edward C. Lawry, Madison, WI
RECOMMENDATION: Add a new Exception to read:
"Exception: Receptacles located behind appliances and not readily accessible with the appliance in place."
SUBSTANTIATION: This Exception would delete the requirement for GFCI protection for washing machines and dryers located in large bathrooms if the receptacle is not readily accessible when the appliance is in place. Many inspectors currently do not require GFCI protection for these receptacles. Some inspectors will require single receptacles if GFCI protection is not provided. This Exception is similar to Section 210-8(a)(2) Exception No. 2.
PANEL ACTION: Reject.
PANEL COMMENT: The need for the exception is unsubstantiated. There is no guarantee that the appliance will not create a safety hazard.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Hazzard, Rao, Vaughan.
EXPLANATION OF VOTE:
HAZZARD: There is no guarantee that any appliance will not create a safety hazard. Laundry equipment located in a bathroom area would not be any more hazardous than other locations and this is the only place laundry receptacles are required to be protected by GFCI.
RAO: This proposal should have been accepted in principal as the submitter's substantiation is valid. An exception should be made for dedicated appliance receptacles.
VAUGHAN: Same as Proposal 2-40.

Log # 1809
2- 39 - (210-8(a)(1), Exception-(New)): Reject
SUBMITTER: Joseph Penachio, Revere, MA
RECOMMENDATION: Add a new Exception as follows.
Exception: Laundry receptacles rendered inaccessible by appliances occupying dedicated space.
SUBSTANTIATION: GFCI Protection should not be required and is not practical for clothes washers and gas dryers located in bathrooms. Exception would be similar to exception for refrigerators, freezers, etc. in (a)(5).
PANEL ACTION: Reject.
PANEL COMMENT: A properly functioning clothes washer will not trip a GFCI. If the leakage current from the washer is sufficient to trip the GFCI, the washer poses a potential shock hazard.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 9
NEGATIVE: Hazzard, Vaughan.
EXPLANATION OF VOTE:
HAZZARD: Laundry equipment located in a bath area is no more hazardous than when located in the basement.
VAUGHAN: Same as Proposal 2-40.

Log # 1948
2- 40 - (210-8(a)(1), Exception-(New)): Reject
SUBMITTER: William F. Nagle, Town of Danvers, MA
RECOMMENDATION: Add exception to Article 210-8-A-1
When the laundry is located in the bathroom, it may be permissible to install a single outlet for the washing machine, keep it low behind the appliance and non-GFCI.
SUBSTANTIATION: As an Electrical Inspector, I have observed on a re-inspection of a dwelling for (addition, swimming pool, etc.) that the GFCI receptacle for the washing machine had been replaced by the homeowner with a non-GFCI receptacle, due to nuisance tripping caused by the motor of the washing machine. In 2 cases it had been replaced by a 2-wire receptacle non-grounding type. I consider this to be a hazardous practice. With a receptacle in the bathroom required by Article 210-52-C and GFCI Article 210-8-A1 it is unlikely a person would pull the washing machine out from the wall, unplug it, and use the receptacle.
PANEL ACTION: Reject.

PANEL COMMENT: The substantiation is contradictory to the proposal.

Eliminating the GFCI protection does not eliminate the problem with a faulty appliance. The washing machine can provide the electrical hazard and the tripping GFCI could be an indication of a dangerous condition.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Vaughan.

EXPLANATION OF VOTE:

VAUGHAN: As a 33 year volume electrical contractor, I agree with the submitter. A very large percentage of the fractional horsepower rated appliances have current leaks in excess of 5 milliamperes, accordingly will trip the GFCI's. In the 1987 NEC, we made a similar exception with the kitchen refrigerator within 6 feet of the kitchen sink.

Log # 2966
2- 41 - (210-8(a)(1), Exception No. 1-(New)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Add an exception as follows:
Exception: One receptacle located within dedicated space for each laundry appliance which in normal use is not easily moved from one place to another.
SUBSTANTIATION: Many laundry facilities are now being located in bathrooms areas. It is not reasonable, and it invites tampering, to subject homebuyers with older appliances to the nuisance tripping inherent when ground fault protective devices are required to be installed ahead of (or part of) these receptacles. This proposal is an extremely limited one. It is restricted to a single receptacle for each qualifying appliance. It is restricted to a receptacle actually located within the dedicated space, which means it will be difficult to easily access and it will not count as the 210-52(c) receptacle. It is restricted to a stationary appliance. It is far more restricted than the permitted garage exception, and it should be accepted on a similar basis.
PANEL ACTION: Reject.
PANEL COMMENT: The need for the exception is unsubstantiated. There is no guarantee that the appliance will not create a safety hazard.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Hazzard, Rao, Vaughan.
EXPLANATION OF VOTE:
HAZZARD: There is no guarantee that any appliance will not create a safety hazard. Laundry equipment located in a bathroom area would not be any more hazardous than when located in the basement.
RAO: See Comment on Proposal 2-38.
VAUGHAN: Same as Proposal 2-40.

Log # 2210
2- 42 - (210-8(a)(3)): Reject
SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.
RECOMMENDATION: Revise second paragraph as follows:
Delete "6 feet, 6 inches" and insert "8 feet".
Paragraph would then read:
For the purposes of this section, "direct grade level access" is defined as being located not more than 8 feet above grade level and being readily accessible without entering or passing through a dwelling unit.
SUBSTANTIATION: The height of 6 feet, 6 inches is unrealistic when dealing with outdoor receptacles which should have GFCI Protection. We require an outdoor receptacle whether people want it or not. We require that a receptacle be installed near a swimming pool, whether people want it or not. We require all garage receptacles be GFCI protected, whether people want it or not. Now we come along and give them an outdoor receptacle that anyone over 4 1/2 feet tall can reach without even standing on a chair. Remember that the height presently specified is 2 inches shorter than the top of a door. Almost every household now has some type of electric appliance which is used outdoors. If

a homeowner is using any outdoor appliance (weed trimmers, hedge trimmers, etc.), and his required "at grade" outdoor receptacle is on the front of the house, when he goes around back, the appliance will be plugged into whatever outlet he can reach. A large number of receptacles are being installed above wooden decks with open wood railings. These receptacles often are located very close to the railing. These decks may not have steps to make them readily accessible from grade, but the receptacle can be reached while standing "ON" grade. If the 6 1/2 foot dimension was taken from Section 380-8, as I suspect it was, then that section also says that 6 1/2 feet is considered "readily accessible". For safety sake and the protection of the public, let's protect all receptacles "accessible" from grade, not just readily accessible. The other alternative is to require a GFCI Protected receptacle on both the front and rear of a dwelling unit.

PANEL ACTION: Reject.

PANEL COMMENT: Minimum 6 feet, 6 inches mounting height is found to be acceptable by the Panel. There is insufficient substantiation to justify a change to 8 ft.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2562, 2704, 3252

2- 43 - (210-8(a)(3)): Accept

SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2562)

Robert Milatovich, Southwestern Section International Association of Electrical Inspectors (2704)

James E. Goodnough, Contra Costa County Electrical Inspection (3252)

RECOMMENDATION: In last paragraph delete the last eight words:

"without entering or passing through a dwelling unit".

SUBSTANTIATION: In Town Houses (zero lot lines) it is necessary to pass through a dwelling unit to reach the rear yard (outdoor area) where electrical appliances are used outdoors at grade level.

In Atriums, there is an out of doors area totally surrounded by a dwelling unit. Again, electrical appliances are used out of doors at grade level.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Hazzard.

EXPLANATION OF VOTE:

HAZZARD: 210-8(a-3) requires certain outdoor receptacles to be protected by GFCI. The requirement for location of receptacles should be in 210-52(d).

Log # 2766

2- 44 - (210-8(a)(3)): Reject

SUBMITTER: James F. Meehan, New Haven, CT

RECOMMENDATION: Delete the paragraph after the fine print note

SUBSTANTIATION: Reason for the deletion are:

1. - With the various lengths of cords attached to various pieces of electrical equipment, the 6' 6" does not seem to be an ideal answer.

2. - The paragraph beginning with "for the purpose" and ending with "or passing through a dwelling unit" should be in the form of a fine print note or should be in the form of a mandatory requirement. At the present time it is not shown as a fine print note nor does it convey a mandatory requirement as stated in Section 110-1.

PANEL ACTION: Reject.

PANEL COMMENT: A definition of height is necessary.

See Proposal 2-43. It is a mandatory requirement.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2967

2- 45 - (210-8(a)(3)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: In the second paragraph, delete the word "section" and replace it with the word "article".

SUBSTANTIATION: Consider a receptacle located in the exterior wall of a house above an open deck six feet wide, six feet deep, and three feet above grade. It is now clear that this receptacle must have GFCI protection. What is not clear is whether this receptacle meets the requirements of 210-52(d). Some authorities are saying that the cross reference in that section merely alerts the reader to the GFCI requirements, and that that receptacle does not qualify as the outside receptacle because it is not accessible AT grade level, merely FROM grade level. Other authorities maintain that the cross reference indicates panel intent to count such a receptacle as complying with 210-52(d), as well as alerting the reader to the GFCI requirement. Acceptance of this proposal would settle the issue once and for all.

PANEL ACTION: Reject.

PANEL COMMENT: This paragraph refers to Section 210-8(a)(3) only, and not the entire Article 210.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2968

2- 46 - (210-8(a)(3)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Delete the words "to the dwelling unit and" from the second paragraph.

SUBSTANTIATION: The way this section is literally worded, a grade level receptacle supplied from a second floor apartment is exempt from any requirement for GFCI protection. Now that grade level access has been precisely defined, these words do more harm than good.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel assumes the proposal refers to the first paragraph. The Panel has changed the definition so the substantiation no longer applies.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1740

2- 47 - (210-8(a)(3), Exception-(New)): Reject

SUBMITTER: J. Philip Simmons, State of Washington, Dept. Labor & Industries

RECOMMENDATION: Replace the second paragraph with the following:

"Exception: Special purpose receptacles that are of the single and locking type and are located 6 feet 6 inches or more above grade or floor or working platform that has direct grade level access."

SUBSTANTIATION: The present wording has created severe hardships for inspectors trying to apply the rules as well as leaving readily accessible receptacles without GFCI protection. Our jurisdiction has found it necessary to modify this section by state rule.

Receptacles 6 ft. 6 in. or more above grade are still "readily accessible to many people. It is also possible in many types of building construction to have enclosed yards accessible only by passing through the dwelling unit and still have unprotected receptacles with direct grade level access.

The proposed wording will allow special purpose receptacles such as for snow melting equipment to be installed without GFCI's. In addition, it is common in our area to mount 120 volt decorative lighting strings on metal gutters and downspouts which are readily accessible to people that are standing on the ground.

The proposed exception also meets the spirit of Exception 1 and 2 to Section 210-8(a)(2) and Section 380-8(a).

PANEL ACTION: Reject.

PANEL COMMENT: An exception is unnecessary, as anything above 6 feet, 6 inches is not required to have GFCI protection.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1462

2- 48 - (210-8(a)(3), Exception No. 1 and No.

2-(New)): Reject

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add two Exceptions as follows:

"Exception No. 1: Receptacles which are not readily accessible.

Exception No. 2: Receptacles for appliances occupying dedicated space which are cord- and plug-connected in accordance with Section 400-7(a)(6), (a)(7), or (a)(8).

Receptacles installed under Exceptions to Section 210-8(a)(3) shall not be considered as meeting the requirements of Section 210-52(d)"

SUBSTANTIATION: The rationale for the Exceptions to Section 210-8(a)(2) are equally valid for outdoor receptacles. The most common example is a refrigerator, freezer or washing machine on a porch or breezeway, which in some parts of the country is just as likely as in a garage. There may be many other examples of inaccessible receptacles within outdoor equipment boxes which would or could never be used for the outdoor living and gardening applications which this Section is intended to protect.

PANEL ACTION: Reject.

PANEL COMMENT: There is no substantiation that a problem exists with the present requirements.

Major appliances such as refrigerators and freezers are not intended to be installed outdoors.

The Panel believes that there should be no exception and that the GFCI should be required in these locations.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Vaughan.

EXPLANATION OF VOTE:

VAUGHAN: We fully agree with the submitter. When a refrigerator, freezer, or washing machine is used from receptacles, which are NOT readily accessible and are located in SHELTERED outdoor porches, or breezeways, they are subject to the same identical technical conditions and therefore, should be subject to the same conditions as when used in kitchens and garages.

Log # 2455

2- 49 - (210-8(a)(4)): Accept in Principle

SUBMITTER: Dennis Booms, Saranac, MI

RECOMMENDATION: New text:

All 125 volt single phase, 15 or 20 ampere receptacles installed in a basement shall have ground-fault circuit-interrupted protection for personnel.

SUBSTANTIATION: The home owner does not know the purpose of ground fault protection! He therefore would not single out the one ground fault receptacle for miscellaneous use. Basements are known for their water problems and consequently the homeowner could draw harm to himself by using any of the other receptacles available in the basement.

PANEL ACTION: Accept in Principle.

Change to "an unfinished basement" from "a basement" in the proposal.

Correct the spelling of "personnel".

Also add 3 new exceptions:

Exception No. 1: A single-outlet receptacle supplied by a dedicated branch circuit which is located and identified for specific use by a cord- and plug-connected appliance, such as a refrigerator or freezer.

Exception No. 2: The laundry circuit as required by Sections 210-52(e) and 220-4(c).

(For Exception No. 3, see Panel Action on Proposal 2-51.)

PANEL COMMENT: The Panel does not intend that GFCI's be required in habitable rooms located in basement areas. The Panel feels refrigerators and freezers may be located in this area and should be exempted.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 4

2- 50 - (210-8(a)(4)): Reject

Secretary's Note: The following proposal consists of Comment 2-80 on Proposal 2-84 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 2-84 was to add a new paragraph to Section 210-8(a) as follows:

(5) At least one 125-volt, single-phase, 15- or 20-ampere receptacle installed in a basement shall

have ground-fault circuit-interrupter protection for personnel and it shall be so identified.

SUBMITTER: A. Albert Biss, U.S. Consumer Product Safety Commission (CPSC)

RECOMMENDATION: The proposal for Ground-Fault Circuit-Interrupter (GFCI) protection for personnel in the basement should be modified by adding the following:

"In basements with adjoining crawl spaces GFCI protection shall be provided for the receptacle nearest the entrance to the crawl space." The reason for this modification is to provide GFCI protection for the receptacle which would most likely be used for pluggin-in portable tools and extension lights when used in crawl spaces.

SUBSTANTIATION: In its analysis of over 3,000 electric shock incidents, CPSC has found the number of electric shock injuries and fatalities occurring in residential basements to be significantly greater than reported by the Underwriters Laboratories (U.L.) Clipping Service. The most comprehensive single source of data on this subject is the "Report on Electrocutions, Electric Shock and Electrical Burn Injuries Involving Consumer Products" by Safety Sciences (September, 1984, San Diego, CA) which includes incidents for the period January 1976 - June 1983. A review of this report and data received since 1983 indicates approximately 312 deaths and 192 injuries involved consumer products commonly cited in scenarios of basement accidents.

The electric shock hazard is also very great in crawl spaces under the home. Included in the above "Report" are 330 in-depth investigations of selected cases. Of these cases the number found occurring in basement or crawl spaces were 26 and of this amount, crawl spaces accounted for 16 fatalities due to faults in portable tools, work lights and extension cords. Thus, crawl space fatalities accounted for 61.5 percent of the basement or crawl space selected cases.

The total number of electric shock incidents is most likely greater than the 3,000 included in the "Report" for the following reasons:

- Only those incidents citing a consumer product are included in the CPSC data base,
- Data for several states were incomplete for 1984,
- The contracted Clipping Service may not be finding all the incidents.

In the NEC Technical Committee Report (TCR), the "Explanation of Vote" for Proposal 2-84 contained two objections raised by the negative voting Panel member as follows:

1. Safety is already afforded by the three-wire system and

2. All cord- and plug-connected equipment should have a 3rd wire for grounding.

Although the three-wire grounding system has been a time-honored system for protecting wiring and equipment, its effectiveness for protecting personnel is dependent on several variables including the following:

- On the integrity (i.e. continuity and ampacity) of the 3rd-wire grounding path.
- On whether the ground fault current reaches the "instantaneous" trip level of the overcurrent device.
- On how quickly the overcurrent device reacts to the fault current.
- On the impedance of the third wire ground.

In regard to the last item, the higher the impedance, the less likely will be the protection afforded by the ground wire. Higher ground wire impedances are due to long lengths and/or small size conductors and extension cords, loose and/or corroded ground wire clamps and connections and other causes such as improper use of plug adapters.

In regard to the second comment which would require a ground wire on all cord connected appliances, this approach is not feasible due to limitations of the three-wire system for protecting personnel as well as other reasons listed below:

- The cost of providing a ground connection on all appliances would be astronomical compared to installing GFCI's.

- Grounding the cases of appliances with exposed heating elements would create a greater hazard such as when a person contacts the live heating element and the enclosure of a toaster while trying to dislodge a piece of stuck bread with a fork.

- U.L. is opposed to a mandatory ground wire on portable heaters since a broken element coil could energize the case without tripping the overcurrent protective device.

- Persons would be subject to injury and fatal shock hazards for several years pending redesign of appliances and many more years until the several hundred million existing two-wire appliances are retired.

- Grounding the cases of all appliances would actually increase the electric shock hazard due to the greater likelihood of a person becoming grounded.

CPSC has studied various methods for protecting personnel from electric shock accidents in the home and has determined that the GFCI is the most effective means. This conclusion has also been corroborated by other including IIT Research Institute (IITRI) in its report on "Electric Shock Prevention Investigation" released in 1977 and by UL in its comments before the NEC Code Making Panel in 1971.

CPSC also has addressed the issue of GFCI nuisance tripping and contracted this year for a consumer use survey of households having GFCI protection. Preliminary analysis of the survey indicates that approximately 90 percent of households regard GFCI's as both IMPORTANT and NOT BOTHERSOME.

Since the GFCI is the most effective and affordable means of protecting personnel from electric shock, CPSC staff recommends adoption of the GFCI proposal as modified for basements.

PANEL ACTION: Reject.

PANEL COMMENT: By the Panel Action on Proposal 2-49, any cord-connected equipment used in a crawl space will have a GFCI receptacle available.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1048

2- 51 - (210-8(a)(4)): Accept in Principle

SUBMITTER: Sam Grossman, Saddle Brook, NJ

RECOMMENDATION: Revise section 210-8(a)(4) to read:

One or more 125-volt, single phase, 15- or 20-ampere receptacles shall be installed in a basement and all shall have ground-fault circuit interrupter protection for personnel and shall be so identified.

Exception No. 1 - Receptacles specifically installed for washers, dryers, sump pumps and like equipment.

SUBSTANTIATION: There is no way to ensure the use of the GFI receptacle in a basement when there is a choice among a number of receptacles. The most convenient one will be used and this will not necessarily be the GFI protected.

PANEL ACTION: Accept in Principle.

Reject the revised first sentence. Add a new Exception No. 3:

"A single-outlet receptacle supplying a permanently installed sump pump.

PANEL COMMENT: A new exception No. 3 has been added to cover sump pumps.

See Proposal 2-49, which addresses the submitter's concerns.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2115

2- 52 - (210-8(a)(4)): Reject

SUBMITTER: Marty Wieder, North Central Texas Council of Governments

RECOMMENDATION: Revise as follows:

(At least one) "All undesignated," 125-volt, single-phase, 15- or 20-ampere receptacle"s installed in a basement shall have ground-fault circuit-interrupter protection for personnel and (it) shall be so identified.

Note: Added material in quotations, deleted material in parenthesis.

SUBSTANTIATION: NCTCOG's Regional Codes Coordinating Committee believes this change is important because it will safeguard homeowners who may not know which basement receptacles have ground-fault circuit-interrupter protection.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is unclear and the Panel believes there is insufficient substantiation. See Panel Action and Panel Comment on Proposal 2-49.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2834

2- 53 - (210-8(a)(4)): Reject

SUBMITTER: A. Albert Biss, US Consumer Product Safety Commission

RECOMMENDATION: Present wording of 8(a)(4):

"At least one 125 volt, single phase, 15- or 20-ampere receptacle installed in a basement shall have ground-fault circuit-interrupter protection for personnel and it shall be so identified."

Proposed Additional Wording:

"In basements with adjoining crawl spaces, the receptacle located nearest the access to the crawl space shall be the identified receptacle."

SUBSTANTIATION: In its analysis of over 3,000 electric shock incidents for the period from 1976 and mid 1984, the Consumer Product Safety Commission (CPSC) had found approximately 312 deaths and 192 injuries involving consumer products in residential basements. In this study, 330 in-depth investigative reports were examined to determine what products were involved and the location. Of the basement fatalities, 61.5% occurred in crawl spaces involving portable power tools, extension lights and extension cords. Furthermore, the death rate in crawl spaces was very great compared to the injury rate, accounting for 86.7% of the electric shock incidents.

More recent incident data obtained from newspaper clippings and published by the Underwriters Laboratories (UL) has also been reviewed. In the last Quarterly Report received, covering the period of July, August and September of 1986, the number of deaths in crawl spaces amounted to six.

CPSC staff recognizes that some of the reported crawl space incidents had occurred in homes which did not have basements. Although the crawl spaces in such homes would not be affected by this proposal, the current Code provides such crawl space protection through the outdoor receptacles which, most likely, would be used for work in the crawl space.

Since the current Code provides for at least one GFCI protected receptacle in the basement, the cost of locating this receptacle nearest the access to the crawl space, in most cases, will be minimal if anything at all. Homes with crawl spaces but without basements and homes built on slabs would not be affected by this modification.

All the technical and economic issues having been fully and adequately addressed in previous GFCI code proposals, the CPSC staff recommends modification of 210-8(a)(4) to include GFCI protection of personnel in basement crawl spaces.

PANEL ACTION: Reject.

PANEL COMMENT: By the Panel Action on Proposal 2-49, any cord-connected equipment used in a crawl space will have a GFCI receptacle available.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3259

2- 54 - (210-8(a)(4)): Accept in Principle

SUBMITTER: Michael L. Last, Tuxedo Park, NY

RECOMMENDATION: Delete:

"At least one", "and shall be so identified."

Substitute: "All" as the first word of the sentence, place a period after "personnel"

Add:

Exception No. 1 to read the same as Exception No. 2 under 210-8(a)(2)

SUBSTANTIATION: By allowing more than one receptacle, it is possible that they might be non-GFCI protected. Utilization equipment normally used out of doors or in another "high-risk" area, might not be connected to the GFCI protected receptacle. By requiring all receptacles to be GFCI protected, would ensure that there is no possibility of any utilization equipment to be non-GFCI protected.

PANEL ACTION: Accept in Principle.
PANEL COMMENT: See Proposal 2-49, which addresses the submitter's concerns. The Panel does not intend that GFCI's be required in habitable rooms except as otherwise specified.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2563, 1233

2- 55 - (210-8(a)(5)): Accept
SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2563)

E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I. (1233)

RECOMMENDATION: Revised text:

All 125-volt, single-phase, 15- or 20-ampere receptacles installed within 6 feet of a kitchen sink to serve counter top surfaces shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: By replacing the present "required by Section 210-52 (b)" wording with "to serve counter top surfaces" we will make clear that ALL receptacles in the 6 foot area will have ground-fault circuit-interrupter protection including the island counter top.

Using the phrase "to serve counter top surfaces" clarifies that outlets such as garbage disposal receptacles are not included. A fine print note could even be added if the panel is so inclined.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 53

2- 56 - (210-8(a)(5)): Accept in Principle
SUBMITTER: Thomas D. Wilhelm, City of University Heights, OH

RECOMMENDATION: Revise text to read as follows:

All 125-volt, single-phase, 15- and 20-ampere receptacles required by Section 210-52(b) for counter top spaces installed within 6 feet (1.83 m) of the kitchen sink shall have Ground Fault Circuit Interrupter protection for personnel.

SUBSTANTIATION: The present wording only requires those outlets installed above counter top surfaces to be Ground Fault Circuit Interrupter protected. This would allow an outlet to be installed below a countertop, such as on the side of an island sink cabinet, to be installed to meet the requirements of 210-52(b) but not be Ground Fault Circuit Interrupter protected.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55. "Required by Section 210-52(b)" has been deleted because the Panel's intent is that all receptacles which serve counter top spaces be protected by GFCI, not just the required ones.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 345

2- 57 - (210-8(a)(5)): Accept in Principle
SUBMITTER: John E. Brezan, Lehigh Valley Elec. Insp. Serv.

RECOMMENDATION: Revise as follows:

(5) All 125-volt, single-phase, 15- and 20-ampere receptacles required by Section 210-52(b) installed within 6 feet (1.83 m) of the kitchen sink shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: Receptacle can be installed within 6 feet of the sink and be mounted in the side of a counter. With the words "above counter top surfaces" in this section, these receptacles can be installed without GFCI protection.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55 and the Panel Comment on Proposal 2-56.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 367

2- 58 - (210-8(a)(5)): Accept in Principle
SUBMITTER: Robert A. McCullough, Ocean County Construction Inspection Dept., NJ

RECOMMENDATION: Revise as follows:

"All 125-volt, single phase, 15- and 20 ampere receptacles required by Section 210-52(b) installed within 6 feet (1.83 m) of the kitchen sink above counter top surfaces or located so as to serve a counter top shall have ground-fault circuit-interrupter protection for personnel."

The requirements of this subsection shall also apply to sink locations other than bathrooms and laundry, such as bar sinks etc.

SUBSTANTIATION: Many receptacles are being installed in the ends or sides of island and peninsula type counters for small appliances. Strict interpretation of the present rule would eliminate the GFCI requirement for these receptacles. Common sense and logic would dictate that if a receptacle is provided for a counter top and it is within 6 feet of the sink, then GFCI protection should be provided. Bar sink areas outside the kitchen should be included in these requirements also. It is not uncommon to find blenders, food processors and the like in use at these locations.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The first paragraph was covered by the Panel Action on Proposal 2-55.

The second paragraph has been rejected. There is no documented evidence of a problem with a bar sink.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 701

2- 59 - (210-8(a)(5)): Accept in Principle
SUBMITTER: Victor V. Timpanaro, Old Bridge, NJ
RECOMMENDATION: Remove "required by Section 210-52(b)" and add "and on outside of lower kitchen cabinets or island counters that are within 6 feet of kitchen sink".

SUBSTANTIATION: Statement "required by 210-52(b)" has raised question of whether outlet installed next to or near sink that may be less than 6 ft and where another outlet installed on same counter and still within 6 ft of sink would be required to be on GFI circuit. Also question of outlets installed on sides of cabinets (counter tops) would be exempted since words "above counter top surfaces" is used. Island counters is typical of installations where outlets may be installed on outside yet not above counter top.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The submitter's proposal has been covered by the Panel Action on Proposal 2-55.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 745

2- 60 - (210-8(a)(5)): Accept in Principle
SUBMITTER: Nicholas R. Rafferty, Wilmington, DE
RECOMMENDATION: Delete text

"above counter top surfaces".

SUBSTANTIATION: Receptacles installed in the face of cabinets below the counter top and in the sides of island cabinet units with sinks are not required to be GFCI protected although the intent of this section appears to provide protection of ungrounded appliances that would also be served by receptacles below the counter.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55, which includes this deletion.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1194

2- 61 - (210-8(a)(5)): Reject
SUBMITTER: Jack Wells, Pass & Seymour, Incorporated
RECOMMENDATION: Revise Section 210-8(a)(5) to read as follows:

210-8(a)(5) all readily accessible 125-volt, single-phase, 15- and 20-ampere receptacles required by Section 210-52(b) which serve kitchen counter areas and are located within 6 feet (1.83 m) of a grounded surface or object shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: Section 210-8(a)(5) is one of the most controversial paragraphs in the 1987 NEC because it is not sufficiently definitive to clearly spell out its intended requirements. This proposal is intended to clarify the requirement as follows:

1. It clearly requires GFCI protection for receptacles that provide power for appliances used on counters whether those receptacles are located over or under the counter regardless of whether the counter runs along the wall or is an island.

2. It clearly recognizes that the hazard exists when an individual touches a grounded surface while holding a faulty appliance. Such accidental ground contact is just as possible be the grounded surface be a sink, refrigerator, dishwasher, range, or terrazzo or tile floor.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel felt from the data presented for the 1987 Code, the greatest area of danger in the kitchen was within 6 feet of the sink, just as in a bathroom. No evidence has been presented here to justify extending the requirement to include other grounded surfaces or objects.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1630

2- 62 - (210-8(a)(5)): Reject

SUBMITTER: William E. Slater, Raco Inc.

RECOMMENDATION: Revise to read as follows:

All 125 volt, single phase, 15 and 20 ampere receptacles required by Section 210-52(b) installed above counter top surfaces, shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: In addition to the kitchen sink, there are other grounded objects within easy reach of the required receptacles, such as, refrigerators, ranges, and dishwashers. The same shock hazard exists between these appliances and an electrically defective tool or hand-held appliance. The kitchen sink is not the only grounded conductive surface within six feet of required receptacle outlets, along counter tops.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel only intends to require GFCI's within 6 feet of the sink. See Panel Comment on Proposal 2-61.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1651

2- 63 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Salvatore Corbino, Bayville, NJ

RECOMMENDATION: Revise as follows:

(5) All 125-volt, single-phase, 15- and 20-ampere receptacles required by Section 210-52(b) installed within 6 feet (1.83m) of the kitchen sink above or serving a counter top shall have ground-fault circuit interrupter protection for personnel.

SUBSTANTIATION: Island counters are within 6' of kitchen sinks but receptacles are below counter tops, the Code at this time does not stat if it should or should not have ground-fault circuit interrupter protection for personnel at the island counter.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The accepted wording refers to all receptacles within 6 feet, not just the required ones. See Panel Action on Proposal 2-55.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1653

2- 64 - (210-8(a)(5)): Reject

SUBMITTER: Mark Bontempo, Waltham, MA

RECOMMENDATION: Sub Paragraph a(5) should read

All 125 volt, single phase, 15 - 20 amp receptacles, including those required by Section 210-52(b), installed within 6 ft. (1.83m) of the kitchen sink shall have ground fault circuit interrupt protection for personnel.

SUBSTANTIATION: 210-8 states that GFCI receptacles shall be installed in accordance with 210-52(b), which calls for only one receptacle. If the Electrician decides to place a multi-duplex receptacle there only one side is required to be GFCI.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not intend receptacles installed under sinks for garbage disposal units or similar receptacles be included in this requirement.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1806

2- 65 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: Delete the word "above"

SUBSTANTIATION: The reference "required by Section 210-52(b)" I believe sufficiently defines the receptacle location.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55, which includes this deletion.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2149

2- 66 - (210-8(a)(5)): Reject

SUBMITTER: Rick L. Gifford, City of Kokomo, IN

RECOMMENDATION: Delete entire 210-8-A-5

SUBSTANTIATION: This article appeared in the 1987 Edition of the N.E.C. without substantiation. I might also submit that in the 1986 T.C.R. pages 65 through 74 additional G.F.C.I. requirements were consistently rejected on the basis of lack of substantiation. Yet we wound up, against consensus opinion, with 210-8-A-5.

I submit that without statistical evidence that a safety hazard exist, we should not be requiring DESIGN cictaria in the N.E.C. and futher increasing cost of construction because SOME inspection officials feel it is a "good idea". We should not be making laws of ANY KIND JUST BECAUSE some few feel it is a "good idea".

PANEL ACTION: Reject.

PANEL COMMENT: Considerable substantiation for the requirement exists in the TCR and TCD for the 1987 NEC Code. The Panel believes the requirement is justified.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2209

2- 67 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.

RECOMMENDATION: Revise Section to read as follows:

All 125-volt, single-phase, 15- and 20-ampere receptacles installed for counter-top use, which are located with-in 6 feet (1.83 m) of the kitchen sink shall have ground-fault circuit-interrupter protection for personnel.

(FPN) to remain as is.

SUBSTANTIATION: It has been argued by some that the present wording does not include all receptacles which are being installed with-in 6 feet of the sink. One example would be an island counter top where by necessity the receptacles are located in the side of the cabinet. Since these outlets are not "above counter top surfaces" it is very difficult to require GFCI protection. There are occasions where the kitchen sink is also located in this island counter top, and although common sense tells us that GFCI protection should be installed, the "words" do not require it. Another example is the fact that 210-52(b) requires that "a receptacle outlet shall be installed for each counter space wider than 12 inches". The argument is that since only one is required, any additional outlets which are installed do not require GFCI protection by 210-8(a)(5), as there is only one required to be installed. It may not be the intent of Panel 2 that the Code be applied in this fashion, but it has been presented this way at Code seminars which I have attended. If the Code is going require that we have GFCI Protection for receptacles within 6-feet of the kitchen sink, then let's protect all the them, amd make it clear what the Code means.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55. Editorially the Panel prefers Proposal 2-55.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 68 - (210-8(a)(5)): Reject

SUBMITTER: J. Philip Simmons, State of Washington/Electrical Inspection SectionRECOMMENDATION: Revise existing text to read as follows:

"(5) All 125 volt, single-phase, 15 and 20 ampere receptacles installed within 6 feet (1.83 m) of the kitchen sink or grounded appliance in the kitchen shall have ground-fault circuit-interrupter protection for personnel.

Exception: Receptacles that are located at least 6 feet, 6 inches (1.98 m) above the floor solely for the electric supply to and support of an electric clock."

SUBSTANTIATION: The present wording has been difficult or impossible to interpret and enforce by the electrical inspectors. Our state found it necessary to modify this section by local rule.

Since two wire appliances are used in the vicinity of ground appliances, the electrical hazard is identical to locations near the kitchen sink. My wife received a severe electrical shock while using an electric fry pan (2 wire) near the grounded electric range.

It is also common to find receptacle outlets installed on the face of cabinets and island cabinet that are intended to comply with the spacing requirements of Section 210-52(a) and (b).

The proposal also provides for protection of other receptacle outlets that are in addition to those that are required to be installed. The present text only covers those that are "required."

PANEL ACTION: Reject.

PANEL COMMENT: The Panel feels that the grounded surface is the same as the grounded appliance. See Panel Action on Proposal 2-61. No evidence has been presented here to justify extending the requirements.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 69 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Richard Lloyd, Huntington, NYRECOMMENDATION: Revise Par. (5) to read:

"(5) All 125-volt, single-phase, 15- and 20 ampere receptacles required by Section 210-52(b) to supply counter top appliances and located within 6 feet of the kitchen sink shall have ground-fault circuit-interrupter protection for personnel. The 6 foot dimension shall be measured with a flexible tape between the face of the receptacle and the nearest rim of the sink.

SUBSTANTIATION: The present wording does not provide protection for receptacles mounted on the verticle side of an island with a sink and which will be used for appliances used on the counter top near or in the sink. The proposed wording does not apply to under counter receptacles used for a garbage disposal nor for a refrigerator. It provides clarification for making the 6 foot measurement.

PANEL ACTION: Accept in Principle.PANEL COMMENT: See Panel Action on Proposal 2-55.

Same as Proposal 2-56.

The Panel feels there are many acceptable ways of measuring the 6-foot requirement. Therefore the proposed last sentence is rejected.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 70 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Delete in the 1st and 2nd lines "... required by section 210-52(b) ..." so it would read:

All 125-volt, single-phase, 15- and 20-ampere receptacles installed within 6 feet (1.83m) of the kitchen sink above counter top surfaces shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: As presently worded, any receptacle(s) installed in addition to those acutally required by section 210-52(b) are not required to have GFCI protection even though they may be within 6 feet of the sink.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55. It is the Panel's intent to protect all 125-volt receptacles that serve counter top surfaces located within 6 feet of the sink, not just above.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 71 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Larry E. Fuhrman, Titusville, FLRECOMMENDATION: Revised text:

All 125 volt single phase, 15 and 20 ampere receptacles required by section 210-52(b) installed within 6 feet (1.83M) of the kitchen sink above counter top surfaces or "installed below counter top surfaces, but intended to serve such conter tops" shall have ground fault circuit interruter protection for personnel.

Note: Added material in quotations.

SUBSTANTIATION: Receptacle outlets installed in cabinet fronts or sides such as island units are not now required to be GFCI protected but they are serving a counter top area which should be protected.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: "Above" and "below" are covered by the Panel Action on Proposal 2-55.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 72 - (210-8(a)(5)): Reject

SUBMITTER: A. Albert Biss, US Consumer Product Safety Commission

RECOMMENDATION: Add the words "and at island counters" to make 210-8(a)(5) read as follows:

All 125 volt, single phase, 15- and 20- ampere receptacles required by Section 210-52(b) installed within 6 feet (1.83M) of the kitchen sink above counter top surfaces "and at island counters" shall have ground-fault circuit-interrupter protection for personnel.

Note: Added material in quotations.

SUBSTANTIATION: The electric shock hazard is very great in kitchen areas around the sink due to various appliance usage on wall counter tops and island counters as well. In its analysis of over 3000 electric shock incidents reported at the previous panel meeting, the Consumer Product Safety Commission found that 55 electrocutions and 230 injuries had occurred in residential kitchens between 1976 and mid 1984. Although the incident data for wall and island counters cannot be separated, the hazard of operating appliances on island counters is just as great as it is on wall counters.

All the technical and economic issues regarding GFCI protection have been fully and adequately addressed at the previous meeting. Since this revision will not require any additional GFCI's or wiring, the CPSC staff recommends protection of the island counter which is within 6 feet of the sink.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not intend that GFCI's be required at island counters if the island counters are not within 6 feet of a kitchen sink.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 73 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Frederic P. Hartwell, Amherst, MARECOMMENDATION: Revise to read as follows:

"All 125-volt, single phase, 15- and 20-ampere receptacles required by Section 210-52(b) or located at a countertop, where installed within 6 feet (1.83 m) of a kitchen sink shall have ground-fault circuit-interrupter protection for personnel."

SUBSTANTIATION: There will undoubtedly be many proposals to resolve the problem with the word "above" in the present Code. This proposal is intended to focus on the fact that not all counter top receptacles

are 210-52(b) required receptacles. CMP 2 action in the previous Code cycle (TCD #2-158) rejecting the comment of the submitter made it quite clear that 15 ampere individual branch circuits with single receptacles for dedicated loads are permitted at countertops. If these receptacles are within 6 feet of the sink they should have GFCI protection as well. The use of the preposition "at" is proper because it tracks the tried and true wording in 210-52(b). In addition, the proposal uses the indefinite article in referring to kitchen sinks; many kitchens have more than one sink. This proposal will continue to exempt receptacles in dedicated space behind refrigerators, or for garbage disposers, etc. which is proper.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Same as Panel Comment on Proposal 2-56.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2701, 3253

2- 74 - (210-8(a)(5)): Accept in Principle

SUBMITTER: Robert M. Milatovich, Southwestern Section International Association of Electrical Inspectors (2701)

James E. Goodnough, Contra Costa County Electrical Inspection (3253)

RECOMMENDATION: Change the word "above" to "at". The section would then read:

(5) All 125-volt, single phase, 15- or 20-ampere receptacles required by Section 210-52 (b) installed within 6 feet (1.83m) of the kitchen sink at counter top surfaces shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: Nothing in Section 210-52 (b) requires the receptacle outlets to be installed "above" the counter top. In handicapped units, and in "island" or flat counter space, (a counter top with no back splash), receptacle outlets are placed in the cabinet face. The present wording could be construed to require GFCI protected receptacles only "above" counter tops.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Same as Panel Comment on Proposal 2-56.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3260

2- 75 - (210-8(a)(5)): Reject

SUBMITTER: Michael L. Last, Tuxedo Park, NY

RECOMMENDATION: Add:

"The 6 foot (1.83 m) shall be measured from the outermost points of the sink and shall be measured horizontal, vertical and diagonal."

SUBSTANTIATION: The wording now in print would seem to exclude those receptacles placed above the level of the sink surface. This could include a light fixture which incorporates a receptacle, mounted above the sink and used for illumination of the in or above sink work area. It should be made mandatory for any and all receptacles (except those listed in the FPN to this section), that are located above or at the sink counter top surface to be GFCI protected.

PANEL ACTION: Reject.

PANEL COMMENT: The Code is clear and additional wording is unnecessary.

Receptacles in light fixtures over sinks are not designed to serve counter top surfaces. See Proposal 2-55. A receptacle in the kitchen must be on the small appliance branch circuit.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 806

2- 76 - (210-8(a)(5) and Exception-(New)): Accept in Principle

SUBMITTER: Edward C. Warner, Routt County Regional Building Dept.

RECOMMENDATION: Revise as follows:

All accessible 125V single phase 15- and 20- ampere receptacles required by Section 210-52b installed within 6 feet (1.83 m) of the kitchen sink shall have ground fault circuit-interrupter protection for personnel.

Add:

Exception: Those receptacles located so they can only be used specifically for appliances such as refrigerators and freezers are exempt.

SUBSTANTIATION: As an electrical inspector I have seen many receptacle installations in kitchen islands with kitchen sinks where the receptacles are mounted in the face of the island counter. Under the present wording of Article 210-8-(5), these receptacles would not have to be ground fault protected.

I feel these installation are just as critical to life safety as the above counter receptacles within six feet of the kitchen sink.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55. The present wording does not apply to receptacles provided for refrigerators, and similar appliances. It applies only to receptacles to serve counter top surfaces. The FPN further clarifies this intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1921

2- 77 - (210-8(a)(5) and Exception No. 1-(New) and

Exception No. 2-(New)): Accept in Principle

SUBMITTER: John E. Brezan, Lehigh Valley Electrical Inspection Service

RECOMMENDATION: Delete the words above counter top surfaces, and add exception #1 under counter receptacles for appliances such as, dishwashers, garbage disposals, etc.

Exception #2 clock receptacles

SUBSTANTIATION: The installations of receptacles in the side of counters or plug mold on the face or side of counters removes these receptacles from the requirement of ground fault circuit interrupter protection for personnel, but can leave the receptacle within the six (6) foot measurement of the kitchen sink.

See panel comment for action on proposal 2-69

(NEC-TCR-86-A page 72 log #632)

1st 2nd 3rd

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The words "above counter top surfaces" were deleted by Panel Action on Proposal 2-55. See Panel Comment to Proposal 2-76 which addresses the rejection of Exception No. 1. Present wording already exempts clock receptacles so Exception No. 2 is unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2297

2- 78 - (210-8(a)(5), and Exception-(New) and FPN):

Accept in Principle

SUBMITTER: Arthur Freund, Electrical Construction and Maintenance Magazine

RECOMMENDATION: Revise Section 210-8(a)(5), add Exception, and delete FPN as follows (changes in quotations):

All 125-volt, single-phase, 15- and 20-ampere receptacles required by Section 210-52(b) "or permitted by Section 220-4(b)(2)" installed within 6 feet (1.83 m) of the kitchen sink above counter top surfaces shall have ground-fault circuit-interrupter protection for personnel.

"Exception: Receptacles which are located specifically for appliances such as refrigerators and freezers."

Delete (FPN)

SUBSTANTIATION: Sec. 220-4(b)(2) permits small appliance outlets in the kitchen in addition to those required by Section 220-4(b)(1). As Section 210-8(a)(5) is now written, these additional appliance outlets are not required to be protected by ground-fault circuit-interrupters, even if installed within 6 feet of the kitchen sink above counter top surfaces. These unprotected outlets, such as those often built into lighting fixtures located under upper kitchen cabinets, present the same hazard to personnel as outlets required by Section 210-52(b)

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-55. See Panel Comment on Proposals 2-70 and 2-76.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2664

2- 79 - (210-8(a)(5), and Exception-(New) and FPN):
Accept in Principle
SUBMITTER: Patricia B. Horton, Allied Tube & Conduit Corporation
RECOMMENDATION: Delete "above countertop surfaces".
Delete the FPN.
Add:
Exception: Receptacles which are located specifically for refrigerators, freezers, or built-in garbage disposals, trash compactors, and dishwashers.
SUBSTANTIATION: To assure that all receptacles, not dedicated for the specific appliances named, which are within 6 feet of the kitchen sink are GFCI protected. People are ingenious and may not necessarily use only a "counter top" within 6 feet of the sink. This covers all contingencies.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: Above "counter top surfaces" has been deleted by the Panel Action on Proposal 2-55. The rest of this proposal is rejected.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2765

2- 80 - (210-8(a)(5) and FPN): Reject
SUBMITTER: James F. Meehan, New Haven, CT
RECOMMENDATION: Delete at end of second line after "sink" the words "above counter top surfaces"
There are many so called summer kitchens wherein the freezer of refrigerator are installed on concrete slab. The use of GFCI in these areas should have a better safety record for protection of personnel.
SUBSTANTIATION: The fact that dedicated spaces for refrigerators and freezers would be exempt from the requirement of G.F.C.I. for personnel should be in a mandatory requirement and not just by a FPN as at present.
Also there are many places where GFCI for personnel would be required wherein the outlets could and have been installed other than above the counter top. Consider a free standing island which is within six feet of a sink.
Re: FPN. Safety should be the prime reason for having GFCI rather than the fact that an appliance may be in a dedicated space.
PANEL ACTION: Reject.
PANEL COMMENT: The deletion of "above counter top surfaces" has been addressed by the Panel Action on Proposal 2-55.
The Panel notes that there is no recommendation concerning the FPN.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2119

2- 81 - (210-8(a)(5), FPN): Accept
SUBMITTER: Chad R. Tombarello, Special T Co.
RECOMMENDATION: Change the word "section" to "subsection".
SUBSTANTIATION: Editorial. To clarify that the (FPN) applies to (a)(5).
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2881

2- 82 - (210-8(a)(5), FPN): Reject
SUBMITTER: Paul E. Phelan, New Hampshire Electrical Contractors Assoc. Inc.
RECOMMENDATION: Change "for appliances such as refrigerators and freezers" to read "for refrigerators, freezers, microwave ovens and similar appliances".
SUBSTANTIATION: The terms "refrigerators" and "freezers" apply to a specific type of appliances (motorized compressor type) which tends to exclude other types.
PANEL ACTION: Reject.
PANEL COMMENT: There is no substantiation to extend the exception for refrigerators and freezers to microwave ovens and similar appliances.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 52

2- 83 - (210-8(a)(6); 210-8(a)(7)-(New)): Reject
SUBMITTER: Thomas D. Wilhelm, City of University Heights, OH
RECOMMENDATION: Renummer existing sub-section #(6) to #(7) and add a new sub-section (6) to read as follows:
All 125-volt, 15- and 20-ampere receptacles installed for use at counter spaces within 6 feet of any sink shall have Ground Fault Circuit Interrupter protection for personnel.
SUBSTANTIATION: This new sub-section would require Ground Fault Circuit Interrupter protection at wet bars and similar areas where a receptacle outlet is not required by 210-52(b) but may be installed. The hazard to personnel is just as great as in kitchens but Ground Fault Circuit Interrupter protection for personnel is not currently required by the wording of the present sections.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel intends that GFCI receptacles be required within 6 feet of a kitchen sink. The substantiation does not support GFCI requirements for other sinks.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1232

2- 84 - (210-8(a)(7)-(New)): Reject
SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I.
RECOMMENDATION: Amend 210-8-(a) by adding a new number (7):
The load side of a ground-fault circuit-interrupter device shall not supply lighting outlets in combination with receptacle outlets unless all the lighting outlets and receptacle outlets supplied are located outdoors. Smoke detectors shall not be located on the load side of a ground-fault circuit-interrupter.
Exception: Lighting outlets required elsewhere in this Code to be G.F.C.I. protected or lighting outlets which do not provide the general lighting for a room, such as shower lights.
SUBSTANTIATION: Tripping of ground-fault circuit-interrupters could endanger a person by leaving him or her in a completely dark area or require someone to travel through a completely dark area to reset a ground-fault circuit-interrupter device.
The purpose of the Code is safety and therefore this change is necessary to insure the high reliability of smoke detectors and lighting outlets. Bathroom receptacles, smoke detectors, lighting fixtures, outdoor receptacles, and all the lighting fixtures between the bathroom and the service panel can be protected by the same ground-fault circuit-interrupter. This change would prohibit this installation.

This new rule would still allow lighting fixtures to be ground-fault circuit-interrupter protected as required by some parts of the Code and it would still allow lights and receptacles on the same circuit providing the receptacles and lights are not on the load side of the same G.F.C.I. The rule would also allow outdoor lights to contain a receptacle on the same G.F.C.I. protected circuit provided all the lighting and receptacles are located outdoors. Smoke detectors should not be on the load side of a ground-fault circuit-interrupter for obvious reasons.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel believes there is more danger from shock than lack of lighting. The subject special requirements for the supply to smoke detectors is outside the scope of CMP 2.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2882

2- 85 - (210-8(a)(7)-(New)): Reject
SUBMITTER: Paul E. Phelan, New Hampshire Electrical Contractors Assoc. Inc.
RECOMMENDATION: Add new para. (7) to read
(7) All 125 volt 15 and 20 ampere receptacles installed in attached greenhouses, solariums etc with tile, masonry or earth floors that may be damp or wet and that are intended to grow and maintain plant life shall have ground fault circuit interrupter protection for personnel.

FPN For the purpose of this requirement areas that are not accessible through a door or similar opening - directly from the dwelling unit shall not be required to comply.

SUBSTANTIATION: These areas are maintained by persons generally unfamiliar with electrical shock hazard.

Barefoot people use household electrical appliances - some of which have been modified to accommodate the plants. Fans, grow-lights, fluorescent fixtures, timers, stereos, are only a few. (Many are 2-wire appliances.)

Local inspectors ask for GFCI but do not have a specific "Code" requirement to support them.

PANEL ACTION: Reject.

PANEL COMMENT: There is not sufficient substantiation to justify GFCI requirements for these locations.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 844

18- 1 - (210-8(a)(7)-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for information.

SUBMITTER: Victor V. Timpanaro, Old Bridge, NJ

RECOMMENDATION: Add Paragraph #7:

"All shower lights" and lights over all tubs approved for the purpose shall be on GFI protected circuit for the protection of personnel.

SUBSTANTIATION: Past codes and present has concerned itself with personnel protection in areas around water, specifically pools, kitchen sinks, bathroom basins and hydromassage tubs, yet have overlooked the shower light which is in direct reach of personnel. I believe this potential hazard deserves immediate attention to rectify this oversight by issuing a T.I.A. Subject to its consideration for 1990 Code.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 18-8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 741

2- 86 - (210-8(c)-(New)): Reject

SUBMITTER: Steven Mueller, Philadelphia, PA

RECOMMENDATION: Add new heading-

(c) Industrial and Commercial Areas. All 125-volt, single-phase, 15 and 20 ampere receptacles installed within 6 feet (1.83 m) of any sink in an industrial or commercial environment, such as a restaurant kitchen, bar, laboratory or janitorial equipment room shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: The existing Code covers the requirements for ground-fault circuit-interrupter protection in dwelling units, hotels and motels, but makes no mention of industrial and commercial areas where water and grounded surfaces can lead to a hazardous environment.

PANEL ACTION: Reject.

PANEL COMMENT: It is not the intention to require GFCI's for commercial and industrial facilities. Sufficient substantiation is lacking to extend the requirements to these occupancies.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1956

2- 87 - (210-8(c)-(New)): Reject

SUBMITTER: Hikaru Okubo, L.A. County Facilities Management Dept.

RECOMMENDATION: Add New Paragraph (c) To Paragraph 210-8 To Read"

OUTDOOR RECEPTACLES. Permanently installed outdoor 125 volt, single phase, 15 and 20 ampere receptacle outlets for general use located in areas readily accessible shall be protected by ground-fault circuit-interrupter for personnel. Screws to secure the receptacle and cover shall be vandal resistant type. SUBSTANTIATION: In many public parks, and other facilities, general use receptacles are installed on lighting poles and other permanent structures for the

convenience of the general public, and for general maintenance work. GF.I. provides shock hazard protection to the uninformed person.

PANEL ACTION: Reject.

PANEL COMMENT: There is insufficient substantiation to extend the requirements to all outdoor locations. Such installations are not now prohibited.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1378

2- 88 - (210-8(c)(1)-(New)): Reject

SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH

RECOMMENDATION: Add:

210-8c. OTHER OCCUPANCIES, BUILDING AND STRUCTURES, COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, ETC.

1) All 125 volt, single phase, 15 and 20 ampere receptacles installed outdoors for these Other Occupancies, where there is direct grade level access to the receptacles, shall have ground-fault circuit-interrupter protection for personnel.

(FPN): See Section 210-8a.3.) - "direct grade level access".

SUBSTANTIATION: 1) This Proposal will provide a higher degree of protection for the maintenance personnel and grounds keeper responsible for maintaining the exterior areas of these occupancies.

Extension cords and electric power tools are commonly utilized outdoors in the above referenced occupancies.

I believe the personnel performing these duties deserve the protection from shock hazard afforded by installing ground-fault circuit-interrupter protection.

The duties performed for these occupancies are comparable to those duties required to maintain the exterior of dwelling units.

PANEL ACTION: Reject.

PANEL COMMENT: It is not the intention to require GFCI's for commercial and industrial facilities. Sufficient substantiation is lacking to extend the requirements to these occupancies.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log #1379

17- 1 - (210-8(c)(2)-(New)): Reject

SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH

RECOMMENDATION: Add:

210-8c. OTHER OCCUPANCIES, BUILDINGS AND STRUCTURES, COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, ETC.

2) In Health Care Facilities, all 125V, single phase, 15 and 20 ampere receptacles installed in bathrooms of patient rooms, shall have ground-fault circuit-interrupter protection for personnel.

SUBSTANTIATION: I see very little difference between bathrooms in Health Care Facilities and bathrooms in Hotels, Motels and Dwellings.

Patients occupying these rooms and using the bathrooms, may stay the night or remain for several days. As a result, the same type of appliances are being utilized (curling irons, shavers, hair dryers, etc.) in these types of bathrooms as in hotels and homes.

I believe the people occupying these rooms deserve the protection which ground-fault circuit-interrupters will provide.

PANEL ACTION: Reject.

PANEL COMMENT: As defined in definition (Section 210-8(b)), proposal would extend requirement to larger area than submitter intended.

Experience data base for health care facilities does not demonstrate acute need (reference Federal Register, October 15, 1987).

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Dragmen.

EXPLANATION OF VOTE:

DRAGMEN: The substantiation is correct and does justify the proposal. The Federal Register article cited as not demonstrating need was not available for Panel review.

COMMENT ON VOTE:

KAHN: Though I agree with the Panel Action and Comment, all bathrooms in Health Care Facilities which fall within the definitions of Bathrooms [Section 210-8(b)] should have ground-fault circuit interrupter protection for personnel. The Proposer's Substantiation is sound for an appropriately modified proposal.

Log # 2970

2- 89 - (210-9):

Secretary's Note: The Correlating Committee directs that the Panel Action on this proposal be reported as "Reject". The subject matter of Section 210-9 is the responsibility of CMP 2. See Correlating Committee Action on Proposal 13-20. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Delete 210-9 in its entirety.
SUBSTANTIATION: This section belongs in Article 450, and a parallel proposal has been submitted to so locate it. The hazards of the unknown voltage to ground on the secondaries of autotransformers that do not have a common grounded circuit conductor brought through apply whether or not a branch circuit overcurrent device is located on the load side of the secondary. The fact that this section is located in Article 210 has been interpreted by some to permit, for example, a 240 volt distribution panel to be connected from a 600 to 240 volt autotransformer; the panel then supplying 240 volt branch circuits. If the 600 volt distribution is ungrounded, which is commonly the case, and accidental ground on the wrong leg of the 600 volt system will raise the 240 volt loads to 600 volts to ground. This is equally true if the autotransformer directly supplies the branch circuit, or if it supplies a feeder from which branch circuits are supplied.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 72

2- 90 - (210-10, Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 210-10, add:

"Exception: where used, handle ties shall not be installed to permit independent switch handle operation."

SUBSTANTIATION: Same as Proposal 2-6.

PANEL ACTION: Reject.

PANEL COMMENT: Section 210-10 already adequately describes that all poles of multiple switching devices shall manually switch together. The exception is unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1119

2- 91 - (210-10(a), Exception No. 1): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 5 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line as indicated:

... to the grounded "(neutral)" conductor is ...

SUBSTANTIATION: Same as Proposal 2-12.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel assumes this refers to Section 200-10(a) and refers it to CMP 5 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1202

2- 92 - (210-11-(New)): Reject

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: Add:

210-11 Tub and Shower: A local containing a fixed tub and shower presents a risk for a person in direct contact with water whose electrical conductivity is very high. This article will cover the measures for safety in this location.

a - ZONES OF RESTRICTION:

(1) WATER ZONE It is considered the Tub or Shower cubicle, this zone is limited by the interior dimensions of the tub or the basin of the shower, and 7 feet 6 inches (2.29 m) in height above the maximum water level of the tub or basin of shower.

(2) ARM'S REACH ZONE It is considered also as protection cubicle in which the accessibility is possible to touch from any point on a surface where a person usually immersed or standing in the tub or shower can reach in any direction without assistance. This zone surrounds the tub or the basin of the shower and is located 5 feet (1.52 m) from the inside walls of the tub or shower basin, and 7 feet 6 inches (2.29 m) in height above the maximum water level of the tub or shower basin.

b - GENERAL SAFETY: In the water zone (tub or shower cubicle) no electrical equipment, appliance, device, receptacles, lighting outlets, lighting fixture, and no provision for connecting portable equipment shall be installed in the interior of the tub or shower cubicle, the safety source shall be installed out of reach of a person using the tub or the shower.

c - RECEPTACLES:

(1) Receptacles shall be outside of the Arm's reach zone (protection cubicle) around the tub or shower.

(2) 125 volt receptacles located within 10 feet (3.05 m) of the inside walls of a tub or the basin of the shower shall be protected by a ground fault circuit interrupter.

Socket outlets shall have no accessible metallic parts.

d - WALL SWITCHES: Switches shall be located outside the Arm's reach zone (protection cubicle) at least 5 feet (1.52 m) measured horizontally from the inside walls of the tub or the shower basin, and shall be so situated as to be normally inaccessible to a person using tub or shower and shall have no accessible metallic parts.

e - LIGHTING FIXTURES AND LIGHTING OUTLETS:

(1) Lighting fixtures and lighting outlets located inside of Arm's reach zone shall be fixed and protected against water (suitable for wet locations) with a glass or plastic lens and non metallic trim, or insulated metallic trim, suitable for use in wet locations.

(2) Lighting fixtures and lighting outlets located interior the Arm's reach zone and over the water zone (over the tub or shower cubicle) shall be protected by a ground fault circuit interrupter.

(3) In the rest of the location lighting fixtures shall be grounded.

f - ELECTRIC EQUIPMENT:

(1) All electric equipment located in the Arm's reach zone shall be protected by a ground fault circuit protection. In the rest of the local and outside of this zone all electric equipment shall be grounded.

(2) METHODS OF GROUNDING:

All electric equipment shall be grounded in accordance with article 250 and connected by the wiring methods of chapter 3.

Where equipment is connected with a flexible cord the equipment grounding conductors shall be connected to a fixed metal part of the assembly.

g - ELECTRIC WATER HEATER:

All electric tub or shower heaters shall be listed and have the heating elements subdivided into loads not exceeding 48 amperes and protected at not more than 60 amperes.

h - WIRING:

(1) Insulated conductors: Insulated conductors used in this local shall be with insulation suitable for use in wet locations (310-8).

(2) conduits: Rigid non metallic conduit is better for use in wet location. All supports, bolts, straps, screws . . . shall be of corrosion-resistant materials or protected against corrosion by approved corrosion resistant materials.

i - BONDING:

The following parts shall be bonded together:

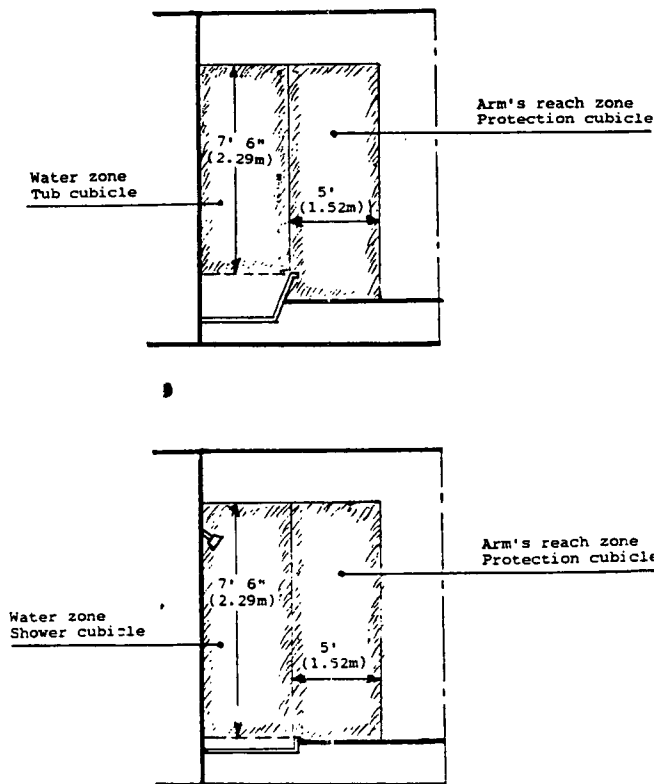
(1) All metal fittings within or attached to the tub or the shower structure.

(2) Metal conduit, metal piping and all metal surfaces, accessible and located interior of arm's reach zone and not separated from the tub or shower area by a permanent barrier. It is recommended not to use any portion of those conduits or pipings . . . as a bonding conductor.

j - METHODS OF BONDING:

All metal parts associated with the tub or shower shall be bonded by any of the following method:

Provided between simultaneously accessible exposed conductive parts of equipment, the interconnection of threaded metal piping and fittings, metal to metal mounting on a common frame or base, or by provisions of a copper bonding jumper, insulated covered, or bare not smaller than n 8 solid.



- Water zone and Arm's reach zone are in a location contain a fixed tub or shower.

SUBSTANTIATION: - It is not essential in the NEC CODE to be limited by the functional definition of Bathroom 210-8(b), but to deal with the danger resultant from the presence of water and electricity in these locations. It seems that the danger from the tub or shower is more important than that from the basin.

- A person in the tub or shower is in direct contact with water, his electrical conductivity is very high.

- The proposal is to add a new article n 210-11, to cover the general precautions in these locations.

- The tub or shower is commonly used almost in every house, and they are used by persons dear to us, therefore we would like the regulation in this subject to be very complete and clear for their safety.

PANEL ACTION: Reject.

PANEL COMMENT: Most concerns of the submitter are presently covered by Section 210-8. A new section is unnecessary. There is no substantiation to include the new areas such as wall switches, lighting fixtures, water heaters, and other wiring methods.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2215

2- 93 - (210-19(a), FPN; 215-2(b), FPN): Reject

SUBMITTER: Murrey L. McKinney, McKinney & Associates

RECOMMENDATION: The recommendation of sizing conductors for a maximum of 3% voltage drop on branch circuits and 5% overall for feeders and branch circuits, should be made a Code requirement and not just a recommendation.

SUBSTANTIATION: Since a fine print note (FPN) is only a recommendation and not a Code requirement conductors can be sized without regard to voltage drop. If this is done branch circuits with loads such as motors could operate at a reduced voltage level which would increase their ampere draw. This could result in excessive heating in the motor windings or branch circuit conductors.

PANEL ACTION: Reject.

PANEL COMMENT: The FPN's are recommendations and should so remain. The engineer can better balance the voltage drop by not having the voltage drop restriction on the branch circuits or feeders. The substantiation covers motor circuits only and the proposal would make it mandatory for any branch circuit or feeder.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 74

2- 94 - (210-19(b), Exceptions No. 1 and 2): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Re-arrange exceptions as follows:

Existing	Change to
Exception No. 1	"Exception No. 2"
Exception No. 2	"Exception No. 1"

SUBSTANTIATION: These changes are required to conform to the 1984 NEC Style Manual, Part A, A-2c.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2780

2- 95 - (210-19(c)): Reject

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Revise by inserting a new 210-19(c) and renumbering the present 210-19(c) as 210-19(d), so Section 210-19 would read:

210-19 Conductors - Minimum Ampacity and Size.

Remain the same as in 1987

210-19(a) General - Remain the same as in 1987

210-19(b) Household Ranges and Cooking Appliances.

Remain the same as in 1987

210-19(c) Household Electric Clothes Dryers. Branch circuit conductors supplying household electric clothes dryers shall have an ampacity not less than the rating of the branch circuit and not less than the maximum load served.

Exception: The neutral conductor of a 3-wire branch circuit supplying a household electric clothes dryer shall be permitted to be smaller than the ungrounded conductor where it is not used as an equipment grounding conductor as permitted in Section 250-60, but shall have an ampacity not less than 70 percent of the branch circuit rating and shall not be smaller than No. 12 AWG.

210-19(d) Other Loads. Renumbered present 210-19(c)

SUBSTANTIATION: At present, there is no specific permission to reduce neutrals in non-cable assemblies for branch circuits where phase to phase and phase to grounded (neutral) conductor combination loads are served.

Many improperly use Section 220-22 for justification, but that is for sizing feeder or, by reference, service entrance conductor(s). This will permit electric clothes dryers to be treated the same as electric ranges.

PANEL ACTION: Reject.

PANEL COMMENT: Table 250-95 or Section 250-60(b) will not permit a reduced capacity grounding/grounded conductor for ampacities required for household clothes dryers.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2971
2- 96 - (210-19(c), Exception No. 1): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Revise the first sentence to read as follows:

"Tap conductors for such loads shall not be smaller than No. 14 copper or No. 12 aluminum for circuits rated less than 40 amperes and not smaller than No. 12 copper or No. 10 aluminum for circuits rated at 40 or 50 amperes and only where these tap conductors supply any of the following loads:"

SUBSTANTIATION: The suggested rewording more accurately reflects the generally understood meaning of this exception, see for example the NFPA Handbook. However, the present wording would allow smaller conductors, especially #14 TW copper on a 50 ampere circuit because the AMPACITY of this conductor, as opposed to its maximum overcurrent protection, is in fact 20 amperes.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel is interested in the conductor having the necessary ampacity, and is not concerned with the actual wire size.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1121
2- 97 - (210-19(d)-(New) and Exception:-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 210-19(c), Exception No. 2, add:

"(d) Common Neutrals of 3-wire (Single-phase) Circuits Supplied by 2-wire Circuits/Sources. Where used, common neutral circuits of 3-wire (single-phase) circuits supplied by 2-wire (single-phase) circuits shall not be less than the total ampacity of the two ungrounded (phase) conductors connected to the ungrounded supply bus (phase)."

After Section 210-19(d)-(New), add:

"Exception: Where a properly sized neutral is used for each ungrounded conductor of the 3-wire circuit."

SUBSTANTIATION: The undersizing of such common neutrals is not a "Text-book" problem; it is real and on-going. The unsafe condition involves the use of a unique and compact 15/20A, 2-pole circuit breaker with 1 line side and 2 load side terminals which readily interchanges with most regular 15/20A, single-pole circuit breakers to provide a convenient means for converting from 1 circuit to 2 circuit capability. This 2-pole breaker connects to only one bus (phase) on the line side and, on the load side, 2 ungrounded conductors are connected to the breaker terminals and 1 common neutral with ampacity equal to one ungrounded conductor of the 3-wire circuit is connected to the neutral bus (source) to supply line-to-neutral load of both ungrounded circuits of the 3-wire circuit which the undersized common neutral must conduct. See Section 225-7(b) for relevant Code provisions and intentions.

This Section does not provide adequate guidelines for the proper sizing of common neutrals in these common but somewhat unusual circumstances and this change, if approved, will ensure the proper sizing of common neutrals and the enhancement of safety for persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: The definition of a multiwire circuit will prevent the problems referred to in the substantiation.

The circuits described are not a multiwire branch circuit, but 2 individual branch circuits each requiring its own grounded conductor.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1234
2- 98 - (210-21(b)(5)-(New)): Reject
SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I.
RECOMMENDATION: Add:
210-21(b)(5) Receptacle outlets (in other than dwelling type occupancies) shall not be connected to circuits supplying general lighting including office portions of buildings.

SUBSTANTIATION: This has been good design practice for years and is time that it becomes part of the Code for safety related reasons. It is too easy to overload a circuit with a "controlled" amount of lighting load and an "uncontrolled" level of receptacle load.

Article 305, Section 305-4(d) recognizes this as stated in the last part of the paragraph: "Receptacles on construction sites shall not be installed on branch circuits which supply temporary lighting."

Section 210-19(a) states: "Branch circuit conductors shall have an ampacity not less than the maximum load to be served. In addition, conductors of multioutlet branch circuits supplying receptacles for cord- and plug-connected portable loads shall have an ampacity of not less than the rating of the branch circuit." This section implicitly recognizes the same principle as that which is behind our proposal. When receptacles are mixed with lights there is no way to assure a 100% load limit, let alone 80%.

This proposal simply carries out the logic that is implicit in Sec. 210-19(a) and does for the general public what we already do for ourselves on construction sites; in Sec. 305-4(d).

PANEL ACTION: Reject.

PANEL COMMENT: This is a design consideration. This is not prohibited by the present Code. If the circuit becomes overloaded it will be protected by the branch-circuit overcurrent device.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2305
2- 99 - (210-22(a), Exception-(New)): Reject
SUBMITTER: John Schoenfeld, Cincinnati, OH
RECOMMENDATION: Add an exception:

In dwellings a circuit may supply the disposal and a dishwasher fastened in place when the total rating of both units does not exceed 90% of the circuit rating.

SUBSTANTIATION: Most dwellings with dishwashers and disposals have equipment rated at 1200 watts or less for dishwashers and 960 watts or less for disposals. The 2160 watts of load would be 90% of the 2400 watts available on a 120 volt, 20 ampere circuit. Normally this load would not be on simultaneously as the disposal is in use for the rough cleaning of dishes and utensils while the dishwasher is in use after being loaded. Even if the disposal and dishwasher operate together, the 90% use of the circuit would be adequate for the normally short duration of use of a disposal.

PANEL ACTION: Reject.

PANEL COMMENT: This is already permitted by Section 430-53 and is unnecessary as an exception here.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2972
2- 100 - (210-22(c)): Accept
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Revise to read as follows:
"The rating of a branch circuit serving continuous loads, such as store lighting and similar loads, shall be not less than the noncontinuous load plus 125% of the continuous load."
SUBSTANTIATION: As presently worded, this subsection is in conflict with 220-3(a) as this section was properly revised in 1987. The proposed wording removes the conflict.
PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 587
2- 101 - (210-22(c), Exception No. 1): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Delete.
SUBSTANTIATION: Motors with demand factors (assumed to be per Table 430-22(a) Exception) would not be continuous loads therefore no exception is needed. Motor loads would not usually exceed 80 percent of the branch circuit rating in order to avoid nuisance operation of the overcurrent device. The label in devices re: 80 percent loading is usually for "other than motor loads".
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1122

2- 102 - (210-23): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second and third lines in the third sentence as indicated:

... size in (a) through ((c)) "(d)" below ...

SUBSTANTIATION: Editorial. To correct an apparent omission.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1252

2- 103 - (210-23(a), Exception): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second and third lines of the Exception as indicated:

... by Section 220-4(b)(1)" shall supply only ...

... in that section(.) "except as permitted in

Exception No 1 and 2 of that section."

SUBSTANTIATION: This change is needed to clarify and conform to the provisions and intent of Section 220-4(b)(1) and Exception No 1 and 2.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal would result in redundancy because the exceptions are part of the initial reference.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 588

2- 104 - (210-23(d)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Multioutlet branch circuits larger than 50 amperes shall supply only nonlighting loads as permitted in Section 210-3 Exception."

SUBSTANTIATION: Since Section 210-3 generally pertains to multioutlet circuits but the first paragraph only applies the "two or more outlets" to subsections (a) through (c), subsection (d) could be construed as applying to individual circuits. The reference to Section 210-3 Exception would correlate the two sections.

PANEL ACTION: Reject.

PANEL COMMENT: It is intended that branch circuits larger than 50 amperes, both individuals and multioutlet branch circuits, supply only nonlighting outlet loads. The proposal is already covered.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3177

2- 105 - (210-24, Exception): Reject

SUBMITTER: Martin J. Behling, Wisconsin Utilities Association

RECOMMENDATION: Add sentence to exception as follows:

"In multi-family dwellings, such circuits shall not be supplied from a dwelling unit branch circuit panelboard."

SUBSTANTIATION: Circuits utilized for central alarms, signal, communication, etc., should not be derived from individual dwelling unit branch circuit panelboards as such panelboards may be de-energized due to unit vacancies, non-payment of bills, etc. Connection to a building service panel will provide a more reliable source to such circuits.

PANEL ACTION: Reject.

PANEL COMMENT: On occasion the circuits referred to in Section 210-24, Exception may be derived from the panel in the manager's dwelling unit.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1420

2- 106 - (210-51-(New)): Reject

SUBMITTER: Tom Rea, International Association of Electrical Insp.

RECOMMENDATION: Add:

Receptacle outlets shall be installed wherever portable cords would be used. Every commercial, office

building, office area, restaurant, store or similar uses, a receptacle outlet shall be installed so that no point along a wall space, as measured horizontally along a continuous wall surface in that space, is no more than six feet from a receptacle outlet. Wall space includes sliding panels in exterior perimeter walls, all other portions of fixed walls, partitions, and other fixed room dividers where not occupied by doors, drawers, cabinets, shelves, and etc. Where the installation of a receptacle outlet in the floor within one foot of the wall shall be considered as being on/in the wall. Receptacle outlets shall insofar as practicable, be spaced equal distances apart.

Receptacles outlets six feet, six inches and above shall be switched by a wall switch in the same room containing the receptacle outlet. The provisions of this section shall not apply to a clock hanger receptacle which is used solely for electric clocks.

SUBSTANTIATION: The lobby and office occupancy of Commercial/Industrial structures have been constructed with a bare minimum of receptacle outlets and generally have been installed with one outlet per office. When these areas are finally occupied with people and furniture it is amazing what an inspector will find on a follow-up inspection of these properties. In some cases the desk is not located near the receptacle outlet, or in addition maybe there are two desks which in turn you would find a cube tap installed on the receptacle outlet, or in some cases two or three cube taps installed piggy back and in turn may be three or four or more extension cords. Now these items are for temporary useage, but in some cases some people consider temporary as forever.

The occupant has no idea of Code requirements and he needs the receptacle outlets, and installs them in the only way he knows how. If there had been installed a number of equally spaced receptacle outlets in these areas at the beginning it would eliminate a great portion of temporary material being used by novices as permanent wiring. Secondly, it would save time for the inspection entity whether it be City Inspector, Fire Marshall, or Insurance Inspector for these Code violations. The reinspections are very costly, as are the installation of receptacle outlets to correct these violations. In turn it will reduce the number of cord related fires across the nation. These particular cord related fires have been reported in the I.A.E.I. News since 1950.

The only other alternative the local jurisdiction has for this matter is to amend the N.E.C., but I feel it should be covered by the N.E.C. for all jurisdictions thus providing uniformity across the nation.

PANEL ACTION: Reject.

PANEL COMMENT: In commercial buildings walls are frequently covered by display cases, cabinets, etc. so outlets along the wall would be inaccessible. Walls in commercial establishments are often mobile and are frequently torn down and relocated.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1227

2- 107 - (210-52(a)): Accept in Principle

SUBMITTER: Harvey L. Bowles, Herndon, VA

RECOMMENDATION: Add "hall," after bedroom in the first sentence.

SUBSTANTIATION: Home builders are not installing receptacles in the halls of new homes because the NEC does not require the receptacles. Often extension cords are run through bedroom doorways for lamps in the halls. To eliminate the extension cords and the associated hazards, receptacles should be required in residential hallways.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Proposal 2-137 to Section 210-52(g)-(New). The receptacle in the hall is warranted in long halls.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Rao.

EXPLANATION OF VOTE:

RAO: See comment on Proposal 2-137.

2- 108 - (210-52(a)): Accept in Principle
SUBMITTER: Joseph McCann, City of Coral Springs, FL
RECOMMENDATION: Revised text:

In every kitchen, family room, dining room, living room, parlor, library, den, sun room, bedroom, recreation room, or similar rooms of dwelling units, receptacle outlets shall be installed so that no point along the floor line is 6 feet (1.83M) from an opening measured horizontally and 12 feet from an outlet in that space, including any wall space 2 feet or more in width. The wall space afforded by fixed room dividers, such as free standing bar type counters, shall be included in the 6 foot (1.83m) measurement.*

*On openings in exterior walls over 12 feet, a receptacle outlet shall be installed within 18 inches of each side of the opening. This would eliminate the use of floor outlets in the middle of sliding glass doors.

SUBSTANTIATION: 210-52A now reads that receptacle outlets shall be installed so that no point along the floor line in any wall space is more than 6 feet measured horizontally (when it actually means 6 feet in each direction or twelve feet).

Also, it would eliminate sliding panel in exterior walls and where an opening in an exterior wall is over 12 feet in width a receptacle outlet would be placed within 18" of each side of the opening.

PANEL ACTION: Accept in Principle.

In the existing text to Section 210-52(a) first sentence, change at the end of the sentence "and the wall space occupied by fixed panels in exterior walls, but excluding sliding panels in exterior walls."

PANEL COMMENT: The proposal would create confusion as to where the 18 inches is measured from. The Panel believes that a sliding panel is a door and a fixed panel is a wall.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 109 - (210-52(a)): Accept in Principle
SUBMITTER: James M. Jagers, Wyoming, MI
RECOMMENDATION: Add-

In hallways, foyers, corridors, and the like one receptacle shall be required for every 12 lineal feet or portion thereof. Receptacle outlets shall be so installed so that no point in the floor line is more than 6 feet measured horizontally from an outlet in that space.

SUBSTANTIATION: Currently no outlets are required in hallways. Floor cleaning equipment must be powered from adjoining rooms. This leads to stretched cords, bent and damaged plugs and receptacles, and cords running from room to room.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Proposal 2-137, to Section 210-52(g)-(New). The Panel agrees with the substantiation but felt that receptacles were unnecessary in short halls. The Panel considers corridors the same as hallways. There is no substantiation to include foyers.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Rao.

EXPLANATION OF VOTE:

RAO: See comment on Proposal 2-137.

2- 110 - (210-52(a)): Accept in Principle
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Revise the first sentence from ". . . or similar rooms . . ." to ". . . or similar areas . . .".

SUBSTANTIATION: Modern architectural design often incorporates large areas with no wall separations for differing uses. "Greatrooms" often contain a "dining area" not a "dining room".

PANEL ACTION: Accept in Principle.

Change existing text to "similar room or area".

PANEL COMMENT: The Panel does not want to exclude similar rooms.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 111 - (210-52(a)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Add a sentence at the end of the second paragraph:

"A wall space equal to the width of a hinged doorway used to enter the room need not be included if it is parallel to the direction of travel through the doorway, and if it begins less than 12 inches (305 mm) from the doorway."

SUBSTANTIATION: This proposal will make this section agree with its own fine print note, in that these areas are never used for furniture placements and therefore never result in cords running across doorways. The Code should say what it means and mean what it says. If this proposal is rejected, then the panel should delete the fine print note. This inspector deals with more complaints on this issue than any other, and frequently from members of the general public who then loudly complain to the political authorities. In every case, the argument runs that the area will never be used for furniture, and the fine print note is cited in defense of their argument. Very few inspectors routinely enforce this requirement in doorways for similar reasons. A companion proposal to amend the fine print note has been submitted; this proposal or that one should pass, but not both.

PANEL ACTION: Reject.

PANEL COMMENT: The receptacle required within 6 feet of the opening is very often the only receptacle accessible for use, as the others are covered up after the placement of furniture. The FPN says to minimize, not eliminate.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 112 - (210-52(a), FPN): Accept in Part
SUBMITTER: Leonard L. Johnson, Baltimore, MD
RECOMMENDATION: Relocate second FPN to 210-50 and delete words "dwelling unit"

210-50
(FPN): Listed baseboard heaters include instructions which may not permit their installation below receptacle outlets.

SUBSTANTIATION: As written it leads someone to believe that the restriction is only for dwelling units. Many baseboard heaters installed in office buildings and similar buildings have the same restrictions.

PANEL ACTION: Accept in Part.

Reject the relocation. Accept the deletion of "dwelling unit".

PANEL COMMENT: The Panel agrees with the substantiation but feels the location is more appropriate here. The FPN needs to be located near this exception as the instructions are often overlooked.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 113 - (210-52, FPN): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Delete the second (FPN)

SUBSTANTIATION: Baseboard heaters never contain listing instructions prohibiting installation below "dwelling unit receptacle outlets". They contain listing instructions prohibiting installation below ALL receptacle outlets. This inspector has already had to deal with commercial baseboard heaters installed below receptacles because the fine print note restricted itself to dwelling units, which is the scope of this section. The unfortunate manner in which this wording was accepted in 1987 effectively precluded comment on this. This wording has no place in this section; it belongs in Article 424 and the submitter has made an appropriate proposal thereto.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 2-112. The Panel agrees with the substantiation that the prohibition is not limited to dwelling units, and for this reason "dwelling unit" was deleted. The FPN is necessary as it provides necessary guidance to the installer.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 114 - (210-52(a), FPN): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: The fine print note should be worded as follows:

(FPN): This requirement is intended to minimize the use of cords across doorways, fireplaces, and similar openings and in addition to provide unobstructed access to at least some receptacles.

SUBSTANTIATION: The first fine print note should be changed to reflect the fact that under current panel thinking, furniture placements are not the only motivation for the rule. There are other reasons having to do with a desire to have some receptacles likely to remain readily accessible without placing additional specific design criteria in the Code mandating, for example, receptacles in hallways, etc. The present wording of this fine print note causes more problems for the submitter from the general public than any other section of the Code; people constantly request waivers under 90-4 on the basis that the absence of furniture placements indicates equivalent safety can be maintained even with the various receptacles eliminated. This proposal should either be accepted, or else the companion proposal to modify 210-52(a) should be accepted; if both are rejected we will remain with a Code that says one thing and means another.

PANEL ACTION: Reject.

PANEL COMMENT: The addition to the FPN does not clarify or change the intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 115 - (210-52(b)-(New)): Accept

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: CMP 2

RECOMMENDATION: Renumber the existing subsections.

Make a new Section 210-52(b):

210-52(h) Small Appliances.

(1) The two or more 20-ampere small appliance branch circuits required by Section 220-4(b) shall serve all receptacle outlets, including refrigeration equipment, in the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling unit. Such circuits, whether two or more are used, shall have no other outlets.

Exception No. 1: A receptacle installed solely for the electrical supply to and support of an electric clock in any of the rooms specified above.

Exception No. 2: Outdoor receptacles.

Exception No. 3: In addition to the required receptacles specified by Section 210-52, switched receptacles supplied from a general-purpose branch circuit as defined in Section 210-70(a), Exception No. 1 shall be permitted.

(2) Countertop receptacle outlets installed in the kitchen shall be supplied by not less than two small appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the kitchen and other rooms specified in (b)(1) above. Additional small appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in (b)(1) above.

SUBSTANTIATION: To relocate data from Sections 220-4(b)(1) and 220-4(b)(2) to better fit the scope of these two articles.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

SPARLING: In line with action on Code Prop. 2-55 the following wording changes should be made:

210-52(b)(2) First line - Change "Countertop" to "All". Second line - after "kitchen" insert "serve countertop surfaces".

If this cannot be accomplished please include as a comment for action in San Diego.

2- 116 - (210-52(x)-(New) and 220-4(b)): Accept in Principle

Secretary's Note: See Secretary's Note, Proposal 2-11.

SUBMITTER: J. Philip Simmons, State of Washington, Dept. of Labor and Industries

RECOMMENDATION: ACCEPT THE PROPOSAL and number properly.

SUBSTANTIATION: The requirements for the LOCATION of small appliance circuit receptacles has been located improperly in Article 220 for a great many years. This has caused confusion and difficulty in finding the proper Code rule. The text remains unchanged and should be located in Article 210.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See CMP Proposal 2-115 to Section 210-52(b)-(New) for minor corrections to omissions in the original.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 117 - (210-52(X)-(New) and 220-4(b)): Accept in Principle

Secretary's Note: The following 2 proposals consist of Comments 2-118 and 2-119 on Proposal 2-161 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. These Comments were held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 2-161 was as follows:

Move the last sentence of Section 220-3(b)(1), Exception Nos. 1 and 2, and Section 220-3(b)(2) to Section 210-52 and there make a new subsection to read as follows:

210-52(x) Small Appliance Branch Circuits. The two or more 20-ampere small appliance branch circuits required by Section 220-3(b), shall serve all receptacle outlets in the kitchen, pantry, breakfast room, and dining room of a dwelling unit.

Exception No. 1: A receptacle installed solely for the electric supply to and support of an electric clock in any of the rooms specified above.

Exception No. 2: Outdoor receptacles.

(xx) Countertop receptacle outlets installed in the kitchen shall be supplied by not less than two small appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the kitchen and other rooms specified in (x) above. Additional small appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in (x) above.

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: The Panel should accept this proposal.

SUBSTANTIATION: Placing this information within Article 210 will aid in properly locating the small appliance circuits within a dwelling.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Same Panel Comment as Proposal 2-116.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 118 - (210-52-(New)): Accept in Principle

SUBMITTER: J. Philip Simmons, State of Washington, Dept. Labor & Industries

RECOMMENDATION: Add:

210-54. Small Appliance Receptacle Outlets.

(a) Circuits Required. Two or more 20 ampere small appliance branch circuits shall be installed to serve all receptacle outlets required by Section 210-52 in the kitchen, pantry, breakfast room, and dining room of a dwelling unit. Such circuits, whether two or more are installed, shall have no other outlets.

Exception No. 1: A receptacle installed solely for the electric supply to and support of an electric clock in any of the rooms specified above.

Exception No. 2: Outdoor receptacles.

(b) Kitchen Countertop Receptacles. Countertop receptacle outlets installed in the kitchen shall be supplied by not less than two small appliance branch circuits, either or both of which shall also be

permitted to supply receptacle outlets in the kitchen and other rooms specified in (a) above. Additional small appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in (a) above.

SUBSTANTIATION: This proposal moves text from Section 220-3(b) which describes the locations where the small appliance receptacle outlets may be located. The present text does not fit within the scope of Article 220 which is "for determining the number of branch circuits required and for computing branch-circuit and feeder loads."

Article 210 properly describes locations of the receptacle outlets. Kitchen receptacle outlets and circuit requirements should be located in Article 210 to comply with the NEC Style Manual to reduce confusion by the users of the Code.

This proposal is similar to one made for the 1987 NEC. However, since the proposal was not "Held for further study" it is uncertain as to its status.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel feels this more properly belongs in Section 210-52. See Proposals 2-115 and 2-116.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1235, 2564

2- 119 - (210-52(b)): Accept in Principle

SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I. (1235)

M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2564)

RECOMMENDATION: Revise as follows:

210-52(b) Counter Tops. In kitchen and dining areas of dwelling units a receptacle outlet shall be installed at each counter space 12 inches (305 mm) or wider. Counter top spaces separated by range tops, refrigerators, or sinks shall be considered as separate counter top spaces. Receptacles rendered inaccessible by appliances fastened in place or appliances occupying dedicated space shall not be considered as these required outlets.

SUBSTANTIATION: Change text to include counter tops of 12 inches (305 mm) wide. Twelve inch counter tops are a standard kitchen item. Appliances are used on these counter top therefore receptacles are needed.

PANEL ACTION: Accept in Principle.

Accept the proposal except the first sentence which has been modified by the Panel Action on Proposal 2-120.

PANEL COMMENT: See substantiation on Proposal 2-120.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2516

2- 120 - (210-52(b)): Accept

SUBMITTER: Frank K. Kitzantides, National Electrical Manufacturers Assn.

RECOMMENDATION: Revise the first sentence by adding "and located so that no point along the counter space is more than 24 inches (609 mm), measured horizontally from a receptacle outlet."

SUBSTANTIATION: An ever increasing number of electrical appliances are requiring dedicated outlet receptacles for full time power. Programmable coffee makers, radios and microwave ovens require power full time in order to operate a clock circuit and a memory circuit for programs. This means that some outlets are no longer available for the temporary use of portable mixers, can openers, electric knives, blenders, toasters, waffle irons, fry pans, etc. The requirement for more dedicated outlets promotes the use of cube taps and other multiple outlet adaptors. Since more counter top outlets are now required, the N.E.C. must keep pace with new technology. Many portable appliances are now supplied with 18" cords which would also make this change desirable.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Cunningham, Rao, Vaughan.

EXPLANATION OF VOTE:

CUNNINGHAM: The Code Panel Accepted this proposal with the understanding that this would result in a maximum distance between counter top receptacle outlets of 48 inches. However, a close examination of the wording could lead to an interpretation that the 24 inches could be a radius from the receptacle outlets. This would make it impossible for space on a counter deeper than 24 inches to comply unless surface mounted receptacles were installed.

I am voting against the Panel action because the wording could be interpreted to require more receptacles than the panel, and perhaps the proposer initially intended.

RAO: The proposed wording is not clear.

VAUGHAN: As a volume electrical contractor, having installed 4 or more duplex receptacles, constituting 8 or more receptacles, on 2 or more 20 ampere circuits in over 60,000 residential dwelling units during the past 33 years, we have received many requests from many of the home buyers for the need for additional receptacle outlets in kitchens. Electrical requirements should most certainly be based on overwhelming substantiated requirements, not on an unlikely rare requirement. Furthermore, with the mixture usage of a very few short cords with the longer cords, the present 8 or more receptacles would be more than adequate to cover the home owners requirements. This proposed additional requirement would needlessly increase the receptacles, in some instances, over 25% in kitchens, resulting in the primary financial benefit going to the manufacturers, with no additional safety, and the additional unnecessary costs being imposed upon the home owner.

Log # 589

2- 121 - (210-52(b)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise third sentence as follows:

"Receptacles to which access is hindered by appliances fastened"

SUBSTANTIATION: The definition of accessible indicates this word is not appropriate, as appliances are not building structures or guards but could be considered obstacles hindering access.

PANEL ACTION: Reject.

PANEL COMMENT: The present wording in the Code adequately describes which receptacles will not be accepted. The substantiation shows no evidence of a problem.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1033

2- 122 - (210-52(b)): Accept in Principle

SUBMITTER: Albert A. Hums, Mishawaka, IN Municipal Utilities

RECOMMENDATION: Revise the first sentence by adding "and, located so that no point along the counter space is more than 16 inches (407 mm) from a receptacle outlet".

SUBSTANTIATION: An ever increasing number of electrical appliances are requiring dedicated outlet receptacles for full time power. Programmable coffee makers, radios and microwave ovens require power full time in order to operate a clock circuit and a memory circuit for programs. This means that some outlets are no longer available for the temporary use of portable mixers, can openers, electric knives, blenders, toasters, waffle irons, fry pans, etc. The requirement for more dedicated outlets promotes the use of cube taps and other multiple outlet adaptors. Since more counter top outlets are now required, the N.E.C. must keep pace with new technology.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel agrees with the substantiation but believes that the spacing accepted in Proposal 2-120 satisfies the needs more equitably.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Vaughan.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-120.
VAUGHAN: Same as Proposal 2-120.

Log # 2120

2- 123 - (210-52(b)): Reject

SUBMITTER: Eric J. Tombarello, Special T Co.

RECOMMENDATION: Delete the word "a" and replace with "at least one".

SUBSTANTIATION: Some interpret the words "as required by 210-52(b)" as referenced in 210-8(a)(5) to require GFCI protection for one receptacle only i.e. a second receptacle within 6 ft. would not require GFCI protection.

This revision would, also, correlate with 210-52(c), (d), (e), and (f).

PANEL ACTION: Reject.

PANEL COMMENT: All receptacles within 6 feet must have GFCI's. The submitter's concern has been addressed by the Panel Action on Proposal 2-55 to Section 210-8(a)(5).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2151

2- 124 - (210-52(b)): Accept in Principle

SUBMITTER: Rick L. Gifford, City of Kokomo, IN

RECOMMENDATION: Revise the first sentence by adding, "and located so that no point along the counter top is greater than 16" inches from receptacle outlet."

SUBSTANTIATION: An ever increasing number of counter top appliances are requiring outlets. The majority of these appliances have cords 18" in length for safety reasons. That safety is negated by multi-top EXTENSION CORDS in order to locate the appliance in a convenient location. This change would allow the elimination of multi-top blocks and extension cords.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel agrees with the substantiation but believes that the spacing accepted in Proposal 2-120 satisfies the needs more equitably.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Vaughan.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-120.

VAUGHAN: Same as Proposal 2-120.

Log # 2565

2- 125 - (210-52(b)): Accept in Principle

SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors

RECOMMENDATION: Insert after the first sentence: before second sentence.

*For counter tops larger than 3 feet in length receptacle outlets shall be installed within 3 feet of each end of the counter top and every 6 feet thereafter measured along the rear of the counter top.

SUBSTANTIATION: There is no ruling for spacing of electrical outlets on counter top other than larger than 12 inch counter requires an outlet after which you would have to use 210-52(a). It is possible to have a counter top 12 feet long with 1 receptacle outlet on it. With the increased number of kitchen appliances used in todays modern kitchen this measurement would be totally inadequate. This proposal would also limit the use of multi plug adapters often seen used in homes with multiple appliances plugged into them.

Example of New Proposal

A counter top 7 feet long unbroken would require 2 receptacle outlets.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel agrees with the substantiation. See Proposal 2-120 which satisfies the needs of the submitter.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Vaughan.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-120.
VAUGHAN: Same as Proposal 1-120.

Log # 75

18- 2 - (210-52(b)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for information.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Between the second and third sentences add the following (new) sentence:

"Receptacles shall not be installed in a face-up position in counter tops."

SUBSTANTIATION: This change should be adopted because it is a Code requirement in Section 551-7(d) and beyond this, it is a prudent and reasonable safety measure.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel sees no correlation between the proposal and Section 551-7(d).

Receptacles installed in wet locations are covered in Section 410-57(b).

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Wells.

EXPLANATION OF VOTE:

WELLS: This proposal should be referred to CMP 2. As indicated in the proposal, it applies to 210-52(b). The reference to 551-7(d) is incorrect. It should be 551-9(d).

Log # 1192

2- 126 - (210-52(c)): Reject

SUBMITTER: Sam Grossman, Saddle Brook, NJ

RECOMMENDATION: Revise Section 210-52(c) by inserting between "... to the basin location." and "See Section . . .", the following:

Receptacles located in bathrooms located in the bedroom areas of a dwelling unit (single or multi-family units) shall be on dedicated 20 ampere circuits.

SUBSTANTIATION: There is a great use of electrical appliances in bathrooms, some of which can draw as much as 1600 watts each. In addition, those dwelling units with two or more bathrooms in bedroom areas, can have more than one appliance being used at the same time with the resulting tripping nuisance of a 15 amp circuit when all bathrooms are on the same 15 ampere GFCI protected circuit.

PANEL ACTION: Reject.

PANEL COMMENT: The overcurrent-protective device on the branch circuit provides adequate overload protection.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2356

2- 127 - (210-52(c)(1)): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: New text:

Receptacle outlets when required shall not be installed in or within reach (30 inches-762 mm) of a shower or bathtub space.

SUBSTANTIATION: Since there is no requirement now from putting a receptacle in or close to an open shower or bathtub, this would also help standardize the requirement with 550-8F.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal only addresses showers or bathtubs in bathrooms where all receptacle outlets must be on a GFCI. Section 210-52(c) is general provisions and does not have to be compatible with special occupancies.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1427

2- 128 - (210-52(c)(2)-(New)): Reject

SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH

RECOMMENDATION: Add:
210-52c.) BATHROOMS

1) In dwelling units at least one wall receptacle outlet shall be installed in the bathroom adjacent to the basin location. See Section 210-8a.))

2) Receptacle outlets and lighting switches shall not be installed in or within reach [30 inches (72 mm)] of a shower, or bathtub space or enclosure.

SUBSTANTIATION: While performing the electrical inspections in several new homes, dwelling units, and condominiums, I have encountered owners and designers, who install receptacle outlets and/or switches for lighting, fans, etc., adjacent to the tub or shower locations.

Apparently the reasoning is for convenience so a heat/light/fan combination fixture can be easily controlled or for portable whirlpool units which can be readily connected to the wall receptacle outlet.

Understanding the results of combining water and electricity, I see no logical reason for installing a switch or a receptacle less than 30 inches from these locations.

In addition to the GFI protection which is provided, I believe this Proposal will increase the degree of safety and provide additional protection from the hazards of electrical shock.

The Proposal will parallel this section of the NEC with the requirement stated in Section 550-8f.). Aside from physical size, I see very little difference and identical hazards in all bathrooms, regardless of being located in Mobile Homes or in standard dwelling units.

PANEL ACTION: Reject.

PANEL COMMENT: Same as Panel Comment to Proposal 2-127. There is no substantiation for lighting switches.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 76

2- 129 - (210-52(d)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Delete period at the end of the third sentence and amend as indicated:

See Section 210-8(a)(3) "for definition of direct grade level access."

SUBSTANTIATION: This revision is required to conform to the guidelines contained in Section 210-8(a)(3), second sentence.

PANEL ACTION: Reject.

PANEL COMMENT: The reference to Section 210-8(a)(3) covers more than just the definition of direct grade level access.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1034, 2566

2- 130 - (210-52(d)): Reject

SUBMITTER: Albert A. Hums, Mishawaka, IN Municipal Utilities (1034)

M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2566)

RECOMMENDATION: Revise section 210-52(d) as follows:

Outdoor outlets. For a one-family dwelling, at least two receptacle outlets, accessible at grade level, shall be installed outdoors. For a two-family dwelling, at least two receptacle outlets, accessible at grade level shall be installed outdoors for each dwelling unit which is at grade level. See Sec. 210-8(a)(3).

Add fine print note - Reasonable separation of these outlets should provide accessibility around the dwelling perimeter.

SUBSTANTIATION: One outdoor receptacle outlet is usually located either in the front or rear of a dwelling. Obviously, when an outlet is required on the other side of the dwelling either a long extension cord or an indoor non-GFCI outlet is utilized. There is a need for an additional outdoor receptacle with GFCI protection, for one and two family dwellings.

PANEL ACTION: Reject.

PANEL COMMENT: The present Code does not prevent more than one outdoor receptacle outlet. The proposed requirement for more than one is more for convenience than safety.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Carpenter, Roberts.

EXPLANATION OF VOTE:

CARPENTER: The lack of a requirement for an additional outdoor receptacle reasonably separated from the one already required, ie. one in front and one in back of a dwelling, leads to the unsafe use of extension cords, adapters, and other temporary wiring methods. The absence of a receptacle encourages unsafe practices such as running an extension cord through a window or door to an indoor non-GFCI outlet. I feel that this is a justifiable safety requirement.

ROBERTS: See comment on Proposal 2-134.

Log # 2150

2- 131 - (210-52(d)): Reject

SUBMITTER: Rick L. Gifford, City of Kokomo, IN

RECOMMENDATION: Revise 210-52(d) as follows:

Outdoor outlets for one & two family dwellings, shall have at least (2) two receptacle outlets, accessible at ground level for each dwelling unit. Reasonable separation at these outlets should provide accessibility to both front and rear of the structure.

SUBSTANTIATION: At present one outdoor outlet is located in front 'OR' at the rear of the dwelling.

When utilization is required on the other side of the structure not having a GFCI protected outlet one is generally used without G.F.C.I. protection by a small cord generally run through a door or window.

PANEL ACTION: Reject.

PANEL COMMENT: Same as Panel Comment on Proposal 2-130.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Roberts.

EXPLANATION OF VOTE:

ROBERTS: See comment on Proposal 2-134.

Log # 2456

2- 132 - (210-52(d)): Reject

SUBMITTER: Gordon Grzybowski, Belmont, MI

RECOMMENDATION: For a one-family two family dwelling at least TWO receptacle outlets accessible at grade level shall be installed outdoors. One outlet in the front and one outlet in the rear of the dwelling. 210-8(a)(3)

SUBSTANTIATION: For the safety and convenience of all who would operate electrical power hand tools, bush trimmers edgers, etc.

PANEL ACTION: Reject.

PANEL COMMENT: Same as Panel Comment to Proposal 2-130.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Carpenter, Roberts.

EXPLANATION OF VOTE:

CARPENTER: See commit on 2-130.

ROBERTS: See comment on Proposal 2-134.

Log # 2492

2- 133 - (210-52(d)): Reject

SUBMITTER: Carol Cooper, Grand Rapids, MI

RECOMMENDATION: Revised text:

Outdoor outlets for each dwelling unit that is at grade level, at least one receptacle outlets shall be installed outdoors at grade level access. See Section 210-8(a)(3).

SUBSTANTIATION: The requirement should be for three-unit and above if the unit has access to grade level patio, porch, or deck.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not justify extending the requirements beyond one- and two-family dwellings.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2515

2- 134 - (210-52(d)): Reject
SUBMITTER: Frank K. Kitzantides, National Electrical Manufacturers Assn.
RECOMMENDATION: Revised text:
 Outdoor outlets. For a one-family dwelling at least two receptacle outlets accessible at grade level shall be installed outdoors. For a two-family dwelling at least two receptacle outlets accessible at grade level shall be installed outdoors for each dwelling unit which is at grade level. See Section 210-8(a)(3).
SUBSTANTIATION: One outdoor receptacle outlet is usually located either in the front or rear of a dwelling. Obviously, when an outlet is required on the other side of the dwelling either a long extension cord or an indoor non-GFCI outlet is utilized. There is a need for an additional outdoor receptacle with GFCI protection, for one and two family dwellings.
PANEL ACTION: Reject.
PANEL COMMENT: Same as Panel Comment to Proposal 2-130.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 10
 NEGATIVE: Roberts.
EXPLANATION OF VOTE:
 ROBERTS: I agree with the substantiation for the proposal. A requirement for at least two outdoor receptacle outlets at one and two family dwellings is of increased safety importance, especially with the wide-spread of "zero lot line" construction. The use of such outlets for temporary lighting such as at Christmas time add to the need. A possible improvement to the proposal would be to require that one outlet be in front and one in back.

Log # 334

2- 135 - (210-52(f)): Reject
Secretary's Note: See Correlating Committee action on Proposal 1-21.
SUBMITTER: Richard E. Loyd, Arkansas Department of Labor
RECOMMENDATION: New text:
 "Basement - Those areas below grade level not designed to be utilized as habitable rooms or areas, but are designed only for storage or dedicated equipment rooms."
SUBSTANTIATION: Webster's dictionary defines Basement: The part of a building that is wholly or partially below ground level.
 Article 210-52(f) and Article 210-70 states one (1) outlet and one (1) light is required.
 In many dwellings now being constructed, the below grade space (commonly called "basement") is designed as habitable living space. Many electrical contractors and builders interpret the Code as requiring one outlet and one light, without capacity for meeting the requirements of habitable rooms. Many times these rooms are partitioned off, but left to be finished by the owner, who finds out that the service is too small or that they overloaded existing circuits. I therefore believe that the definition in Webster's dictionary does not meet the NEC needs or intent.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel does not believe a definition of basement is necessary in Article 210. As the term is used in other sections of the Code, this proposal could be referred to CMP 1 for action.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1920

2- 136 - (210-52(f)): Reject
SUBMITTER: Raymond P. Pelletier, City of Auburn, ME
RECOMMENDATION: Rework to read:
 "... For dwelling units with basements . . .
SUBSTANTIATION: To correlate with 210-8(a). Not only single family dwellings have usable basements.
PANEL ACTION: Reject.
PANEL COMMENT: Section 210-8(a)(4) does not require a receptacle in basements. It only requires GFCI protection if a receptacle is installed in the basement.
VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 137 - (210-52(g)-(New)): Accept
SUBMITTER: CMP 2
RECOMMENDATION: Add a new Section 210-52(g):
 "(g) Hallways. For hallways of 10 feet (3.05 m) or more in length at least one receptacle outlet shall be required.
 As used in this subsection the hall length shall be considered the length along the centerline of the hall without passing through a doorway."
SUBSTANTIATION: There are no outlets required in hallways at the present time. The Panel believes receptacles are necessary in long halls to avoid equipment being powered from adjoining rooms leading to stretched cords, and bent and damaged plugs and receptacles.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 10.
 NEGATIVE: Rao.
EXPLANATION OF VOTE:
 RAO: The hallway outlet is strictly a convenience outlet that may or may not be useful to the occupants of a dwelling unit. This outlet should not be required. The substantiation of bent or damaged plugs and receptacles can occur at any outlet including a hallway outlet if the user is careless.

Log # 2311

2- 138 - (210-52(g)-(New)): Accept in Principle
SUBMITTER: Daniel P. Brown, County of Summit, OH
RECOMMENDATION: New text:
 210-52(g) New subsection
 Hallways. For a one-family dwelling, at least one receptacle outlet shall be installed in each hallway.
SUBSTANTIATION: Outlets are needed in hallways to facilitate vacuum cleaners, floor scrubbers, night lights etc. This will also eliminate cords being used through doorways, and the hazards involved with their use.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: The submitter's intent has been more specifically addressed by the Panel Action in Proposal 2-137.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 10
 NEGATIVE: Rao.
EXPLANATION OF VOTE:
 RAO: See comment on Proposal 2-137.

Log # 1380

2- 139 - (210-53 and 210-53, Exception-(New)): Reject
SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH
RECOMMENDATION: Add:
 210-53 OTHER OCCUPANCIES, BUILDING AND STRUCTURES, OFFICE, RECEPTION AREA. Office and reception areas in commercial occupancies shall have receptacle outlets installed in accordance with Section 210-52a.)
 Exception: The number of receptacle outlets determined by Section 210-52a.) shall be permitted to be located convenient for permanent furniture layout.
SUBSTANTIATION: The inspections I perform in occupied commercial buildings reveal an extensive number of extension cords in use.
 The Fire Prevention Bureau of our local Fire Department has requested several of these inspections with the intention of eliminating and rectifying these conditions. Several of the problems have occurred in newly constructed or recently renovated buildings. I would assume this situation is not unique to this locality.
 The amount of office equipment requiring electric power appears to be continually increasing. Many of the extension cords travel under desks, chairs and through areas of pedestrian traffic. Most of the cords extend several feet to the receptacles which creates not only an electrical hazard but also a trip hazard for the personnel.
 I believe this Proposal will reduce and help eliminate these UNSAFE conditions and create a much less dangerous atmosphere and an orderly working environment in the buildings for the occupants.

PANEL ACTION: Reject.
PANEL COMMENT: Buildings other than dwellings are usually designed by professional engineers and adequate consideration is given to the location of receptacle outlets.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2481

2- 140 - (210-53-(New)): Reject
SUBMITTER: James M. Jagers, Wyoming, MI
RECOMMENDATION: New text:
Other than Dwelling Units. In hallways, foyers, corridors, or the like one receptacle shall be required for every 12 lineal feet or portion thereof. Receptacle outlets shall be so installed so that at no point in the floor line is more than 6 feet measured horizontally from an outlet in that space.
SUBSTANTIATION: The intent of this proposal is that convenience outlets be provided for cleaning and maintenance.
PANEL ACTION: Reject.
PANEL COMMENT: Same as Panel Comment to Proposal 2-139.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1741

Submitted by J. Philip Simmons for Section 210-54 is now Proposal 2-118 for Section 210-52.

Log # 49

2- 141 - (210-62): Reject
SUBMITTER: Fred Mays, Code Administration, City of Albuquerque, NM
RECOMMENDATION: At least one RECEPTACLE outlet shall be installed directly above a show window for each 12 linear feet (3.66 m) or major fraction thereof of show window area measured horizontally at its maximum width. Delete the word, RECEPTACLE.
SUBSTANTIATION: Deletion of the word, RECEPTACLE, will permit track lighting or recessed lighting in lieu of plugged-in lighting. Increases safety by reducing use of extension cords for lighting.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel's intent is to require a receptacle outlet as designated in Section 210-62. The show window lighting requirement is defined in Section 220-12. The receptacle outlet is not intended to satisfy the requirement for show window lighting.
VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 142 - (210-63): Accept
SUBMITTER: CMP 2
RECOMMENDATION: Revise Section 210-63 to read:
210-63. Heating, Air-Conditioning and Refrigeration Equipment Outlet. A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location for the servicing of heating, air-conditioning and refrigeration equipment on rooftops and in attics and crawl spaces. The receptacle shall be located on the same level and within 25 feet (7.62 m) of the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.
Exception: Rooftop equipment on one- and two-family dwellings.
SUBSTANTIATION: Heating, air-conditioning and refrigeration equipment located in crawl spaces and attics are generally not spaces with easy access. The 125-volt receptacles within 25 feet will allow use of portable tools for equipment repairs. The Uniform Mechanical Code covers the electrical installation in Sections 708 and 709.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 9
NEGATIVE: Rao, Reign.
EXPLANATION OF VOTE:
RAO: Mechanical codes should not dictate electrical requirements. Not all jurisdictions adopt the same mechanical code. Conflicts between different codes

have always been a problem. All electrical requirements in mechanical codes should be removed or changed to conform with the NEC.

REIGN: Reducing the present requirement of 75 feet to 25 feet for the location of a receptacle to service heating, air-conditioning and refrigeration equipment has no technical substantiation. 75 feet does not present any greater hazard than 25 feet. Article 305 does not limit the length of extension cords to 25 feet. The Panel substantiation says the Mechanical Code covers the electrical installation. I always thought that was what the NEC did. It seems to me that the Mechanical Code should revise its electrical requirements to comply with the NEC, not vice versa.

Log # 2569

2- 143 - (210-XXX-(New)): Accept in Principle
SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors
RECOMMENDATION: Add a new Section 210-XXX entitled "Warm Air Furnaces in Attics and Crawl Spaces" to read as follows:
Warm air furnaces located in attics or under floor spaces requiring Electrical connections for more than 50 volts shall have a light switch located at point of entry to the attic or crawl space, a light fixture by the warm air furnace and a 125 volt receptacle within 25 feet of the furnace.
SUBSTANTIATION: Warm air furnaces located in crawl spaces and attics are generally not spaces with easy access. The light switch at point of entry to control light fixture by furnace will give extra safety for the service personnel and others that may be concerned with the furnaces. The 125 volt receptacles within 25 feet will allow use of portable tool for furnace repairs. The uniform mechanical code covers the electrical installation in section 708 and 709. (attached)
Note: The attachments were not received by NFPA.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: The submitter's intent has been more completely addressed by CMP Proposals 2-142 and 2-161 to Sections 210-63 and 210-70(a).
VOTE ON PANEL ACTION:
AFFIRMATIVE: 9
NEGATIVE: Rao, Reign.
EXPLANATION OF VOTE:
RAO: See Comment on Proposal 2-142.
REIGN: See my comment on Proposal 2-142 regarding distance and other codes.

Log # 7

2- 144 - (210-63 and 210-50): Accept in Part
Secretary's Note: The following proposal consists of Comment 2-125 on Proposal 2-164 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 2-164 was as follows:
Add a new Section 210-63 Rooftop Heating, Air-Conditioning, and Ventilating Equipment Outlet. A 125-volt, single-phase, 15- or 20-ampere rated receptacle outlet shall be installed at an accessible location for the servicing of rooftop mounted heating, air-conditioning, and ventilating equipment. The receptacle outlet shall be located on the same roof level and within 25 feet of the heating, air-conditioning, and ventilating equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.
Exception: One- and two-family dwellings.
Section 210-50. General. Change the reference to Section 210-62 to Section 210-63.
SUBMITTER: Stephen C. Ritzenhaler, City of Sandusky, OH
RECOMMENDATION: Require a receptacle outlet, protected by a ground-fault circuit interrupter, accessible and within 25 feet etc.
SUBSTANTIATION: The location of the mentioned equipment is usually on a flat roof where water seems to puddle and accumulate near the rooftop units. This would provide added protection for the service people.

PANEL ACTION: Accept in Part.

The Panel accepted the 25 feet but rejected the GFCI.

PANEL COMMENT: See Proposal 2-142 and there is no substantiation to justify GFCI.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance. Agree that GFCI not required.

Log # 346

2- 145 - (210-63): Reject

SUBMITTER: John E. Brezan, Lehigh Valley Elec. Insp. Serv.

RECOMMENDATION: Revise as follows:

210-63. Rooftop Heating, Air-Conditioning, and Refrigeration Equipment Outlet. A 125 Volt, single phase, 15- or 20-ampere rated GFCI receptacle outlet shall be installed at an accessible location for the servicing of rooftop mounted heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall be located on the same roof level and within 75 feet (22.82 m) of the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.

SUBSTANTIATION: Flat roofs will puddle, or dam, water, holding at the roof under these conditions a repairman, or other person(s) could receive an electrical shock from use of power tools in maintenance of roof mounted equipment.

Please reconsider proposal in NEC-TCR. Atlanta (Log #1555) and consider the handyman, or maintenance man, who may not even know what a portable GFCI is, much less what dangers are present for him without GFCI protection.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 347

2- 146 - (210-63): Reject

SUBMITTER: John E. Brezan, Lehigh Valley Elec. Insp. Serv.

RECOMMENDATION: Revise as follows:

210-63. Rooftop Heating, Air-Conditioning, Ventilating, and Refrigeration Equipment Outlet.

SUBSTANTIATION: Ventilating equipment requires servicing the same as heating, air-conditioning or refrigeration equipment.

PANEL ACTION: Reject.

PANEL COMMENT: Ventilation equipment does not require the extent of servicing as heating and air-conditioning equipment does.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 671

2- 147 - (210-63): Accept

SUBMITTER: William Boyd, Building Department, Town of Snowmass Village, CO

RECOMMENDATION: Change existing distance for required receptacle outlet from "75 feet" to "25 feet".

SUBSTANTIATION: Model mechanical codes require receptacles within 25 feet of the equipment. This distance is more favorable than 75 feet. Most servicemen carry light gauge 100 foot extension cords which could result in excessive voltage drop. The other alternative (sic) is an alligator clip or worse connection on the line side of the equipment. Running an electric drill backed up by a large capacity fuse is a dangerous practice that I have done numerous times for the want of a permanently installed receptacle at a reasonable distance from the equipment.

PANEL ACTION: Accept.

PANEL COMMENT: See Panel Action on Proposal 2-142.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance and other codes.

Log # 698

2- 148 - (210-63): Accept

SUBMITTER: Russ Helmick, Jr., Irvine, CA

RECOMMENDATION: In the second sentence change the requirement of "75 feet" to "25 feet".

SUBSTANTIATION: The statements made to change to 75 feet from the original code proposal about servicemen should have 100 feet cords is nice, but how many really have them or are qualified service type persons? The need for these outlets is for not only serviceing (sic), but for safety as well. Long cords not only have voltage drop to contend with, but dragging them across roofs and other items on the roof create hazards that a shorter cord would prevent. As a contractor I have been involved with repair on roofs, and believe me, I carried only what I had to, as little and as light as possible. As a inspector I have witnessed many persons using disconnects, questionable cord sets, clamps, cords from the floor below, and alot of other methods to aquire power. We now, at least have the requirement in the NEC, but it is still in conflict with the Uniform Mechanical Code, I beleive we should also be striving for uniformity in the electrical industry and the construction industry as well.

PANEL ACTION: Accept.

PANEL COMMENT: See Panel Action on Proposal 2-142.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance and other codes.

Log # 1032

2- 149 - (210-63): Reject

SUBMITTER: Charles G. Hendry, Hempstead, NY

RECOMMENDATION: Add new wording

A 125 volt, single-phase, 15-20 ampere "GFCI" rated receptacle outlet.

SUBSTANTIATION: Roof areas wet due to collection of water. "GFCI" would protect personell working in water from shock from defective cords, cord connections, tool to cord connections in water.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1381

2- 150 - (210-63): Reject

SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH

RECOMMENDATION: Revise as follows:

210-63. ROOFTOP HEATING, AIR-CONDITIONING, AND REFRIGERATION EQUIPMENT OUTLET. A 125v single-phase 15 or 20 ampere rated receptacle outlet shall be installed at an accessible location for the servicing of rooftop-mounted heating, air-conditioning and refrigeration equipment. "This receptacle outlet shall have ground-fault circuit interrupter protection for personnel." The receptacle outlet shall be located on the same roof level and within 75 feet of the heating, air-conditioning and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.

Note: Added material in quotations.

SUBSTANTIATION: The location of the above referenced equipment is usually on a flat roof surface where rain water, snow, and ice have a tendency to puddle and accumulate near the rooftop units.

The people responsible for servicing this equipment are generally working in these wet and damp locations or their portable electric tools, lamps and extension cords are laying in these areas.

I believe this Proposal revision and GFI requirement will provide a much higher degree of protection and safety for the personnel working in these conditions.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1788

2- 151 - (210-63): Accept in Principle

SUBMITTER: Del St. Laurent, Pacific Coast Electrical Association, Inc.

RECOMMENDATION: Revise as follows:

210-63. ROOFTOP HEATING, AIR-CONDITIONING, AND REFRIGERATION EQUIPMENT OUTLET.

A 125-volt, single-phase, 15- or 20- ampere rated receptacle outlet shall be installed at an accessible location for the servicing of rooftop-mounted heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall be located on the same roof level and within "25" feet "(7.62m)" of the heating, air-conditioning and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.

EXCEPTION: One- and two-family dwellings.

Note: Revised material in quotations.

SUBSTANTIATION: Previous panel discussions stating that service-men carry 100 foot cords is not realistic. Many service-men working on roofs do not carry 100 foot cords because of the weight involved. Instead, they use alligator clips or other questionable means to obtain temporary power. At 75 feet, the outlet is beyond the reach of the shorter cords they typically carry. Long cords laying on roofs and obstructions create hazards which would be reduced if the outlet were within 25 feet of heating, air-conditioning and refrigeration equipment. Since other codes currently require the outlet to be within 25 feet, this proposal would also make enforcement more uniform.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Proposal 2-142. "25" feet has been accepted and incorporated.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance.

Log # 2116

2- 152 - (210-63): Accept in Part

SUBMITTER: Marty Wieder, North Central Texas Council of Governments

RECOMMENDATION: Revise as follows:

Roof-top Heating, Air-Conditioning, and Refrigeration Equipment Outlet. A 125-volt, single-phase, 15- or 20-ampere rated receptacle outlet shall be installed at an accessible location for the servicing of roof-top mounted heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall be located on the same roof level and within (75) "25" feet of the heating, air-conditioning, and refrigeration equipment, "as required by the 1985 Uniform Mechanical Code." The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.

Note: Added material in quotations, deleted material in parenthesis.

SUBSTANTIATION: NCTCOG's Regional Codes Coordinating Committee promotes codes coordination and standardization. This proposed change correlates the NATIONAL ELECTRICAL CODE with the UNIFORM MECHANICAL CODE and its more restrictive requirement.

PANEL ACTION: Accept in Part.

The Panel accepts the change to 25 feet but rejects the inclusion of the additional words.

PANEL COMMENT: According to the NEC Style Manual references to other codes are for information only.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance and other codes.

Log # 2213

2- 153 - (210-63): Reject

SUBMITTER: Murrey L. McKinney, McKinney & Associates

RECOMMENDATION: Revised text:

The receptacle shall have ground-fault circuit interrupter protection.

SUBSTANTIATION: There is a potential hazard for personnel who might be operating electrical equipment, such as a drill, and be standing in water that has accumulated on the roof and has not drained off. The water could be in contact with the plumbing vent system and could provide an alternate path to ground.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2306

2- 154 - (210-63): Reject

SUBMITTER: David E. Chartrand, Watervliet, NY

RECOMMENDATION: New text:

Rooftop, heating, air conditioning and refrigeration equipment outlet. A 125 Volt, Single-Phase, 15- Or 20 amperer rated receptacle should be G-F-C-I protected.

SUBSTANTIATION: Protection for personnel

PANEL ACTION: Reject.

PANEL COMMENT: There is no substantiation to justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2394

2- 155 - (210-63): Reject

SUBMITTER: Gregory T. Hyland, A.B.C. 1st Year

Apprenticeship Class, Cincinnati, OH

RECOMMENDATION: The receptacle outlet shall not be connected to the load side of the equipment disconnecting means, "and shall have ground fault circuit - interruptor protection for personnell"

Proposed new text is in quotations.

SUBSTANTIATION: Incorporation of Ground Fault Circuit Interruptor protection on these receptacles would provide a greater degree of personnel safety for persons utilizing these devices. This change would be consistent with the recent addition of Article 511-10. It is obvious that increased safety for personnell provided by this change will accomplish the purpose of the Code as stated in Article 90-1(a)

PANEL ACTION: Reject.

PANEL COMMENT: Reasons for requirements in Article 511 are not appropriate here. There is no substantiation to justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2510

2- 156 - (210-63): Reject

SUBMITTER: Dave Thrasher, Greiner, Inc.

RECOMMENDATION: Add to this section

"... load side of the equipment disconnect mean (see B.O.C.A HVAC Code).

SUBSTANTIATION: This gives credit for where Code requirement originated from & helps promote this needed requirement.

PANEL ACTION: Reject.

PANEL COMMENT: References to other documents are not appropriate.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 157 - (210-63): Accept
SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2567)

Robert M. Milatovich, Southwestern Section
 International Association of Electrical Inspectors (2700)

RECOMMENDATION: In the second sentence change the requirement of 75 feet to 25 feet.

SUBSTANTIATION: The statements made to change to 75 feet from the original Code proposal about servicemen should have 100 feet cords is nice, but how many really have them or are qualified service type persons? The need for these outlets is for not only servicing, but for safety as well, long cords not only have voltage drop to contend with, but dragging them across roofs and other items on the roof create hazards that a shorter cord would prevent. As a contractor I have been involved with repair on roofs, and believe me, I carried only what I had to, as little and as light as possible. As an inspector I have witnessed many persons using disconnects, questionable cord sets, clamps, cords from the floor below, and a lot of other methods to acquire power. We now, at least have the requirement in the NEC, but it is still in conflict with the Uniform Mechanical Code, I believe we should also be striving for uniformity in the electrical industry and the construction industry as well.

PANEL ACTION: Accept.

PANEL COMMENT: See Panel Action on Proposal 2-142.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance and other codes.

2- 158 - (210-63): Reject

SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors

RECOMMENDATION: First line after 15- or 20 ampere rated, insert ground-fault circuit-interrupter protected . . .

The line would then read "A 125-volt, single-phase, 15- or 20- ampere rated, ground-fault circuit-interrupter protected receptacle outlet shall be installed at an accessible location for the servicing of rooftop mounted heating, air-conditioning, and refrigeration equipment."

SUBSTANTIATION: During my years as an Electrical Inspector, examining HVAC equipment on roofs in all kinds of weather, especially rain and snow, I've had concerns for the safety of installers having to work with electrically powered tools in this environment. In talking with installers I've been told of instances of receiving electric shocks, when using electrically powered tools, while working on roof mounted equipment.

Keeping in mind the safety consciousness actions of this Code Panel, I believe this should be the next step for safety in the Electrical Industry.

PANEL ACTION: Reject.

PANEL COMMENT: There is no substantiation to justify GFCI protection on these receptacles.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Carpenter.

EXPLANATION OF VOTE:

CARPENTER: The hazards that are present around HVAC equipment on roofs are enough to justify the additional safety requirements of a GFCI protected receptacle. Do we have to have a "body count" when the hazards are evident.

2- 159 - (210-63): Reject

SUBMITTER: Robert M. Milatovich, Southwestern Section International Association of Electrical Inspectors (2699)

James E. Goodnough, Contra Costa County Electrical Inspection (3254)

RECOMMENDATION: Change to read:

Service and Maintenance Outlet. (Bold Type)

A 125 volt, single phase, 15- or 20- ampere rated receptacle outlet shall be installed at an accessible location for the servicing of equipment. The receptacle outlet shall be located within 25 feet (7.62m) of any equipment requiring service or maintenance. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means. In the case of rooftop equipment, the receptacle outlet shall be located on the same roof level as the equipment.

Exception: One and two family dwellings.

SUBSTANTIATION: The Section, as presently worded, confines the requirement for this outlet to rooftops, and to heating, air-conditioning, and refrigeration equipment.

The attached examples are only two of many instances where service and maintenance outlets are needed, but not required by the National Electrical Code. Other locations are, as an example, elevator machine rooms and pits, escalators, commercial swimming pool equipment rooms, etc. The list could go on and on. The 25 foot section, was in the original 1987 Code proposal, and the reason for the change to 75 feet was "too expensive", and "everyone" has a 100 foot extension cord". To my knowledge, the current listing book by U. L. still says an extension TROUBLE LIGHT cord set is limited to 25 feet. I was also under the impression cost was not to be a factor in determining safety conditions. A service person is not going to look over a radius of 75 feet for an outlet. He might look at 25 feet.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not intend that receptacles be installed within 25 feet of all equipment requiring service or maintenance. The proposal is too broad as it would include any equipment whether it has power or not.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 160 - (210-63 and 210-63, Exception): Accept in Part
SUBMITTER: Tom Rea, International Association of Electrical Insp.

RECOMMENDATION: Revise as follows:

A 125-volt, single-phase, 15 or 20 ampere rated receptacle outlet shall be installed at an accessible location for the servicing of rooftop mounted heating, ventilation, air conditioning, and refrigeration equipment. The receptacle outlet shall be located on the same roof level and within 25 feet (22.82 M) of the heating, ventilation, air conditioning and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.

Exception: One and two family dwellings.

SUBSTANTIATION: From the information I have received, the Uniform Mechanical Code is under various jurisdiction enforcement agencies, from Alaska to California and as far East as the Mississippi River. Most jurisdictions in these areas while enforcing the National Electrical Code also enforce the Uniform Mechanical Code. In some cases when these jurisdictions find codes in conflict with each other, they will require the most restrictive requirements to rule. The 25 foot requirement for outlets has been in the Uniform Mechanical Code since 1970 under section 509. After consulting with various representatives of this Code body, I have been informed they have no intention of changing this Code section. At the 1986 Annual Meeting, National Electrical Code Technical Committee Report Log #1695 was submitted by W.I. Summers, IAEI and was accepted by the Code Panel. I feel this submittal was to make the electrical industry aware of the Uniform Mechanical Code requirement and place this in the National Electrical Code. The 1986 Annual Meeting National Electrical Code Technical Committee Documentation Log #760 which was accepted, changed the outlet requirement from 25 foot spacing to 75 foot spacing. This requirement which is in the 1987

National Electrical Code causes a great deal of the western jurisdictions to enforce the more restrictive requirement of the Uniform Mechanical Code thus placing the Electrical Industry in a very precarious position of corrections or additions in order to comply with this requirement. I sincerely hope that the Code panel will do their ultimate to clarify this conflict of Code requirements.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept in Part.

The Panel accepts the change to 25 feet but rejects the inclusion of ventilation.

PANEL COMMENT: See Proposal 2-142 and Panel Comment to Proposal 2-146.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Rao, Reign.

EXPLANATION OF VOTE:

RAO: See Comment on Proposal 2-142.

REIGN: See my comment on Proposal 2-142 regarding distance and other codes.

2- 161 - (210-70(a) and 210-70(c)-(New)): Accept
SUBMITTER: CMP 2

RECOMMENDATION: Revise Section 210-70(a) and add Section 210-70(c)-(New).

Section 210-70(a) 2nd paragraph revise to read:

"At least one lighting outlet controlled by a light switch located at the point of entry to the attic, underfloor space, utility room and basement shall be installed only where these spaces are used for storage or contain equipment requiring servicing. The lighting outlet shall be provided at or near the equipment requiring servicing."

Add a new Section 210-70(c):

(c) Other Locations. At least one wall switch-controlled lighting outlet shall be installed at or near heating, air-conditioning, and refrigeration equipment in attics or underfloor spaces. The light switch shall be located at the point of entry to the attic or underfloor space.

SUBSTANTIATION: Heating, air-conditioning, and refrigeration equipment located in crawl spaces and attics are generally not spaces with easy access. The light switch at point of entry to control light fixtures by this equipment will give extra safety for the service personnel and others. The Uniform Mechanical Code covers the electrical installation in Sections 708 and 709.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2707

2- 162 - (210-70): Accept in Principle
SUBMITTER: Robert M. Milatovich, Inspection Division, City of Fresno, CA

RECOMMENDATION: Change second paragraph to read:

At least one lighting outlet "controlled by a switch located at the passageway opening" shall be installed in an attic, underfloor space, utility room and basement only where these spaces are used for storage or contain equipment requiring servicing.

SUBSTANTIATION: Safety is the prime purpose of the National Electrical Code and although this is not an electrical safety problem, it is indeed a personnel safety problem in that we require a lighting outlet in these areas, but we do not specify the location of the switch. Because of this we are finding the lighting outlet switch located inside of the areas which means the person must enter the unlighted area and then must locate the switch. This is very dangerous to this person in that they are in the dark while trying to locate the switch and must leave the area in the dark. If you have ever entered a room in which the lamp has needed replacing you will understand how dangerous it can be.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Proposal 2-161.

The Panel feels "point of entry" is the same as "passageway opening".

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 678

2- 163 - (210-70(a)): Reject

SUBMITTER: Richard K. Emmons, Pontiac, MI

RECOMMENDATION: Revise text: (Last paragraph before exceptions.)

"At least one lighting outlet shall be installed in an attic, underfloor space, utility room, walk-in closet and basement only where these spaces are used for storage or contain equipment requiring servicing."

SUBSTANTIATION: A lighting outlet is required in a space that is used for storage but does not specify a walk-in closet space.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal does not define a walk-in closet.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1435

2- 164 - (210-70(a)): Reject

SUBMITTER: Jack Murphy, Deerfield, OH

RECOMMENDATION: Revise as follows:

At least one wall switch controlled lighting outlet shall be installed in every habitable room; in bathrooms, hallways, stairways, attached garages, and detached garages and at outdoor entrances when the outdoor entrance is a primary entrance for entering the dwelling a switch shall control an exterior light or recept. as well as an exterior exit light so located as to be convenient.

SUBSTANTIATION: When entering a house from a rear entrance many contractors place the illuminating switch on the wall opposite the entrance. This has caused many injuries to persons entering a dark room from a rear entrance of a house I personally know of one death where the individual entered thru a rear sliding door stepped on a child's skate and fell backwards thru the glass slider severing his juggler vein. Had illumination been provided this could have been avoided.

Please take note of the comments on page 93 of the N.F.P.A. Electrical Code Handbook. Which states this section points out that adequate lighting and proper control and location of switching is as essential to the safety of occupants of dwellings as are proper wiring requirements. I personally believe that one's life and limb are of greater value than the small expense of adding a light when entering a dwelling from the outside.

PANEL ACTION: Reject.

PANEL COMMENT: There is no evidence that acceptance of the proposal would increase safety. The submitter has not shown that the accident would have been prevented by illumination.

The proposed requirement is impractical and an unnecessary design consideration.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2191

2- 165 - (210-70(a)): Reject

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.

RECOMMENDATION: Add new sentence at end of section to read:

"For entrances and exits a switch shall be located adjacent to each entrance or exit door."

SUBSTANTIATION: This section as presently written requires a wall switch, but has no requirement as to where this switch is to be located. Since we now require a light for exits, and basement doors have been determined to be exits, or entrances, (see proposals and panel intent for 1987 NEC), the question has been raised as to where the switch must be located. I have been told that the light is switched, but the switch is upstairs. How can I argue? How can I enforce intent? The Code does not say where the switch must be. If the owner wants to put the switches in the hallway closet for all the lights in the house, how can an inspector stop him? I did not include habitable rooms in this proposal because there are rooms which have more than one entrance and I don't feel that the Code should require a three or four way switch at every entrance into a habitable room. These switches are usually located at the most used entrance to the room. The

outdoor areas present the most problem in my area. This change will still permit exterior floodlights to be used, (will not require a "light fixture" at each entrance). Exception No. 2 will still take care of exits and entrances to multifamily buildings.

PANEL ACTION: Reject.

PANEL COMMENT: This is an unnecessary design consideration.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2819

2- 166 - (210-70(a)): Reject

SUBMITTER: Larry E. Fuhrman, Titusville, FL

RECOMMENDATION: Revised text:

At least one "switched" lighting outlet may be installed in an attic, under floor space, utility room and basement only where these spaces are used for storage or contain equipment requiring servicing.

Note: Added material in quotations.

SUBSTANTIATION: Code now allows a lamp holder (porcelain) without a pull chain or switch. Adding word switched would eliminate keyless fixture and turning lamp into light and out to extinguish.

PANEL ACTION: Reject.

PANEL COMMENT: The Code already permits the recommendation. The proposal is permissive.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3420

2- 167 - (210-70(a), Exception No. 1): Reject

SUBMITTER: Bernard J. Mezger, American Home Lighting Institute

RECOMMENDATION: Change the wording to read as follows:

Exception No. 1: In habitable rooms, other than kitchens and bathrooms, one or more wall switch-controlled receptacles shall be permitted in addition to the wall switch-controlled lighting outlet.

SUBSTANTIATION: The substantiation is to achieve the most safety possible. National Safety Council data shows that in 1985 home accidents killed 20,500 persons AND seriously disabled 3,100,000. Disabling injuries are greater for home accidents than any other category, including Motor Vehicles which it doubled. That is one out of approximately every 77 persons in U.S. Falls are the second leading cause of death in the U.S. and the leading cause in the home. They peak for the young and older age groups.

It seems reasonable that increasing the odds of preventing an accidental death or disabling accident in the American home would be a contribution.

The probability that the room light will go "on" when the button is pushed with a switched lighting outlet/fixture is three (3) times greater than with a switched receptacle/plug/switched lamp combination. Certainly groping into a dark room significantly increases the accidental fall potential. We should better the odds in the home to decrease accidental falls that do cause death and disability.

PANEL ACTION: Reject.

PANEL COMMENT: This is already permitted and a change to the exception is unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1648

2- 168 - (210-70(c)-(New)): Accept in Principle

SUBMITTER: Ralph R. Bickner, Kimball, SD

RECOMMENDATION: Add paragraph (c) to 210-70

(c) Where lighting outlets are installed according to (a) above in stairways, there shall be a wall switch at each floor level to control the lighting outlet when the difference between floor levels is three steps or more.

All switches installed according to (a) and (b) in 210-70 shall be installed on the strike side of the door when installed next to a doorway in which a door is installed.

SUBSTANTIATION: At the present time the NEC requires wall switches but does not specify where they are to be located. This can create some real hazards. When inspecting residences, the biggest complaint homeowners have is "why don't you require a three-way switch for stairways so I don't have to go back down to the

landing to shut off the entrance stairway light once I have reached the living area". This creates a safety hazard as they are subject to using the stairway without lighting. In both residential and commercial installations, switches for many rooms, especially rest rooms are found behind the door so that it is necessary to go into a dark room and nearly close the door to get to the switch. This may be called a design problem but it is also a safety problem when you have to stumble around in a dark room to find the switch.

PANEL ACTION: Accept in Principle.

The Panel accepts (c) but change "three steps" to "six steps".

The Panel rejects the second paragraph.

PANEL COMMENT: Six steps is the reasonable difference in floor levels.

In some cases it is impractical to locate the switch as requested.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 215 -- FEEDERS

Log # 2786

2- 169 - (215-2): Reject

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Revise 215-2 last sentence so it reads:

Note 3 of Table 310-16 shall be permitted to be used for conductor sizing for other than mobile homes as covered in Article 550.

SUBSTANTIATION: Ever since this sentence was added, there has been confusion as to whether it actually can be used for sizing feeders to mobile homes. I have been informed several times that because article 550 does not repeat this permitted use in article 550, this constitutes a conflict per section 550-3.

If this cannot be used for mobile homes, it should be correlated with article 550.

PANEL ACTION: Reject.

PANEL COMMENT: Section 215-2 covers the feeder to the mobile home while Article 550 covers the distribution panel and supply cord for the mobile home. There is no conflict. The general rule is here. See Section 90-3 in the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1187

2- 170 - (215-2(a)): Accept

SUBMITTER: Frank W. Novitzki, Memphis District, U.S. Army Corps of Engineers

RECOMMENDATION: Revise as follows:

(New wording capitalized)

(a) For Specified Circuits. The ampacity of feeder conductors shall not be less than 30 where the load supplied consists of ANY OF the following number and types of circuits: (1) two or more 2-wire branch circuits supplied by a 2-wire feeder; (2) more than two 2-wire branch circuits supplied by a 3-wire feeder; OR (3) two or more 3-wire branch circuits supplied by a 3-wire feeder.

SUBSTANTIATION: Subparagraph 215-2(a) of the 1987 Code, as written, requires feeder conductor ampacity of 30 where ALL circuit types [i.e. circuit types (1), (2), and (3)] are supplied by a feeder.

The intended requirements of this subparagraph are clarified by requiring this feeder conductor ampacity for ANY of the circuit types stated.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2977

2- 171 - (215-2(a)-(New)): Accept

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Add the following text at the end of this section:

"(4) two or more 4-wire branch circuits supplied by a 3-phase 4-wire feeder."

SUBSTANTIATION: This section does not presently address one of the most common multiwire branch circuits, namely three phase four wire circuits. This oversight should be rectified.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

outdoor areas present the most problem in my area. This change will still permit exterior floodlights to be used, (will not require a "light fixture" at each entrance). Exception No. 2 will still take care of exits and entrances to multifamily buildings.

PANEL ACTION: Reject.

PANEL COMMENT: This is an unnecessary design consideration.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2819

2- 166 - (210-70(a)): Reject

SUBMITTER: Larry E. Fuhrman, Titusville, FL

RECOMMENDATION: Revised text:

At least one "switched" lighting outlet may be installed in an attic, under floor space, utility room and basement only where these spaces are used for storage or contain equipment requiring servicing.

Note: Added material in quotations.

SUBSTANTIATION: Code now allows a lamp holder (porcelain) without a pull chain or switch. Adding word switched would eliminate keyless fixture and turning lamp into light and out to extinguish.

PANEL ACTION: Reject.

PANEL COMMENT: The Code already permits the recommendation. The proposal is permissive.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3420

2- 167 - (210-70(a), Exception No. 1): Reject

SUBMITTER: Bernard J. Mezger, American Home Lighting Institute

RECOMMENDATION: Change the wording to read as follows:

Exception No. 1: In habitable rooms, other than kitchens and bathrooms, one or more wall switch-controlled receptacles shall be permitted in addition to the wall switch-controlled lighting outlet.

SUBSTANTIATION: The substantiation is to achieve the most safety possible. National Safety Council data shows that in 1985 home accidents killed 20,500 persons AND seriously disabled 3,100,000. Disabling injuries are greater for home accidents than any other category, including Motor Vehicles which it doubled. That is one out of approximately every 77 persons in U.S. Falls are the second leading cause of death in the U.S. and the leading cause in the home. They peak for the young and older age groups.

It seems reasonable that increasing the odds of preventing an accidental death or disabling accident in the American home would be a contribution.

The probability that the room light will go "on" when the button is pushed with a switched lighting outlet/fixture is three (3) times greater than with a switched receptacle/plug/switched lamp combination. Certainly groping into a dark room significantly increases the accidental fall potential. We should better the odds in the home to decrease accidental falls that do cause death and disability.

PANEL ACTION: Reject.

PANEL COMMENT: This is already permitted and a change to the exception is unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1648

2- 168 - (210-70(c)-(New)): Accept in Principle

SUBMITTER: Ralph R. Bickner, Kimball, SD

RECOMMENDATION: Add paragraph (c) to 210-70

(c) Where lighting outlets are installed according to (a) above in stairways, there shall be a wall switch at each floor level to control the lighting outlet when the difference between floor levels is three steps or more.

All switches installed according to (a) and (b) in 210-70 shall be installed on the strike side of the door when installed next to a doorway in which a door is installed.

SUBSTANTIATION: At the present time the NEC requires wall switches but does not specify where they are to be located. This can create some real hazards. When inspecting residences, the biggest complaint homeowners have is "why don't you require a three-way switch for stairways so I don't have to go back down to the

landing to shut off the entrance stairway light once I have reached the living area". This creates a safety hazard as they are subject to using the stairway without lighting. In both residential and commercial installations, switches for many rooms, especially rest rooms are found behind the door so that it is necessary to go into a dark room and nearly close the door to get to the switch. This may be called a design problem but it is also a safety problem when you have to stumble around in a dark room to find the switch.

PANEL ACTION: Accept in Principle.

The Panel accepts (c) but change "three steps" to "six steps".

The Panel rejects the second paragraph.

PANEL COMMENT: Six steps is the reasonable difference in floor levels.

In some cases it is impractical to locate the switch as requested.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 215 -- FEEDERS

Log # 2786

2- 169 - (215-2): Reject

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Revise 215-2 last sentence so it reads:

Note 3 of Table 310-16 shall be permitted to be used for conductor sizing for other than mobile homes as covered in Article 550.

SUBSTANTIATION: Ever since this sentence was added, there has been confusion as to whether it actually can be used for sizing feeders to mobile homes. I have been informed several times that because article 550 does not repeat this permitted use in article 550, this constitutes a conflict per section 550-3.

If this cannot be used for mobile homes, it should be correlated with article 550.

PANEL ACTION: Reject.

PANEL COMMENT: Section 215-2 covers the feeder to the mobile home while Article 550 covers the distribution panel and supply cord for the mobile home. There is no conflict. The general rule is here. See Section 90-3 in the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1187

2- 170 - (215-2(a)): Accept

SUBMITTER: Frank W. Novitzki, Memphis District, U.S. Army Corps of Engineers

RECOMMENDATION: Revise as follows:

(New wording capitalized)

(a) For Specified Circuits. The ampacity of feeder conductors shall not be less than 30 where the load supplied consists of ANY OF the following number and types of circuits: (1) two or more 2-wire branch circuits supplied by a 2-wire feeder; (2) more than two 2-wire branch circuits supplied by a 3-wire feeder; OR (3) two or more 3-wire branch circuits supplied by a 3-wire feeder.

SUBSTANTIATION: Subparagraph 215-2(a) of the 1987 Code, as written, requires feeder conductor ampacity of 30 where ALL circuit types [i.e. circuit types (1), (2), and (3)] are supplied by a feeder.

The intended requirements of this subparagraph are clarified by requiring this feeder conductor ampacity for ANY of the circuit types stated.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2977

2- 171 - (215-2(a)-(New)): Accept

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Add the following text at the end of this section:

"(4) two or more 4-wire branch circuits supplied by a 3-phase 4-wire feeder."

SUBSTANTIATION: This section does not presently address one of the most common multiwire branch circuits, namely three phase four wire circuits. This oversight should be rectified.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2976

2- 172 - (215-2(b)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Delete the words "with an ampacity of 55 or less" and replace with the following wording:
"which are No. 6 copper or No. 4 aluminum or smaller"
SUBSTANTIATION: The present wording came into the Code on an editorial rewrite of a proposal to include aluminum conductors; the panel instead, for simplicity, picked an ampacity figure. The problem is that the way the ampacity tables now read, No 8 THHN copper, for example, could be substituted. This was not the intent of the panel as expressed in the panel comment at the time.
PANEL ACTION: Reject.
PANEL COMMENT: This is adequately covered. See Section 110-5.
The substantiation is incorrect because the 60°C rating of No. 6 or No. 8 must be used. The higher ampacity of certain conductors would be permitted only if the terminating equipment is suitable for the higher temperature rating.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1123

2- 173 - (215-4(a)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first sentence as indicated:
Feeders (containing a common neutral shall be permitted to supply) "consisting of" two or three sets of 3-wire feeders, or two sets of 4-wire or 5-wire feeders (.) "shall be permitted to have a common neutral. The ampacity of this neutral shall not be less than that of the maximum net calculated load between the common neutral and the ungrounded conductors connected to any one phase (conductor) of the supply circuit."
SUBSTANTIATION: Section 215-4(a) is not clear as to whether the neutral of the supply feeder or the neutral of the multiple sets of feeders being supplied is being referred to and also there is no clear reference to neutral conductor sizing requirements. This change, if approved, will provide more meaningful clarity and simplicity to ensure the proper sizing of common of feeders in accordance with the applicable provisions/intentions of Sections 220-22 and 225-7(b).
PANEL ACTION: Reject.
PANEL COMMENT: The Panel believes that present method of calculating the size of the neutral conductor is accurate and that the proposal would result in oversized neutral in certain cases.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1205

2- 174 - (215-4(a)): Reject.
SUBMITTER: Hayssam Safadi, Tucson, AZ
RECOMMENDATION: To add in the beginning of the article 215 4(a) the following:
"(where designed for certain conditions, feeders with common neutral shall be installed where specified in (a) and (b) below)."
SUBSTANTIATION: The disadvantages of having a common neutral are more risky than the benefits, therefore the article 215-4 in the NEC CODE should have more restrictions for its use:
- There is no great economic benefit in the cross section of conductor because (the common neutral must have current carrying capacity equal approximately to the sum of the neutral conductor capacities for every individual neutral conductor).
- This arrangement can not help the installation of (GFP) in the future for any feeder (ground fault protection-215-9).
- Generally the neutral conductor depends on the nature and the importance of loads (f.e):
3 phase motor load-system IT-electric discharge lighting-harmonics-sensitive instruments not suitable with perturbations-short circuit currents.
- The practical difficulties are to manipulate and connect the gross cross section (common neutral), maintenance, fault searching and testing, renewal of some feeders, adding new feeders.

PANEL ACTION: Reject.
PANEL COMMENT: The proposed "certain conditions" are not identified in the proposed change.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 77

5- 42 - (215-4(b)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second and third lines of the sentence as indicated:
... using a common neutral "and equipment grounding conductor, where used," shall be enclosed
...
SUBSTANTIATION: In the interest of safety, this change is required because in many systems, an equipment grounding conductor is specified.
PANEL ACTION: Reject.
PANEL COMMENT: This is adequately covered in Section 300-20(a) last sentence.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 231

2- 175 - (215-7): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After the second sentence add as indicated:
"All poles of multiple switching devices shall manually switch together where such switching devices also serve as a disconnecting means as indicated in Section 210-10."
SUBSTANTIATION: This change should be approved to conform to the requirements specified in Section 210-10.
PANEL ACTION: Reject.
PANEL COMMENT: As written it is not clear how the proposal would improve safety. The reason for the reference to Section 210-10 is not clear in the substantiation.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 78

2- 176 - (215-7, Exception-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 215-7, Add:
Exception: Where used, handle ties shall not be installed to permit independent switch handle operation.
SUBSTANTIATION: Same as Proposal 2-6.
PANEL ACTION: Reject.
PANEL COMMENT: When simultaneous disconnection is required, it must be provided by an "approved" means, such as factory-provided handle ties and not by the use of nails, etc.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 590

2- 177 - (215-8): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Delete: "if the neutral conductor is also present".
SUBSTANTIATION: To provide consistency with Section 230-56 and 384-3(e) which require identification whether or not the neutral is present.
PANEL ACTION: Reject.
PANEL COMMENT: If the neutral is not present, there is no reason to identify the conductor with the higher voltage to ground. Section 230-56 refers to services where such identification is necessary and in Section 384-3 the identification is required.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2458

2- 178 - (215-8): Reject
SUBMITTER: Racaal Cata, Grand Rapids, MI
RECOMMENDATION: New text (last part of paragraph):
Such identification shall be placed at each J-Box weather there is a connection or not if the neutral conductor is also present. This identification shall be made at all connection point.
(also hot legs must be identify a pullboxes even if there is no neutral)

SUBSTANTIATION: The reason for having this identification at all J-Boxes and Pull boxes is because; this way, if an electrician was to make a splice out of this existing circuit, he would have knowledge as to where the higher voltage is.
PANEL ACTION: Reject.
PANEL COMMENT: If the neutral is not present, there is no reason to identify the conductor with the higher voltage to ground.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 743

2- 179 - (215-9): Reject
SUBMITTER: Mark Lobach, Chesapeake City, MD
RECOMMENDATION: Add:
All 240 volt GFCI protection should be provided by a double pole GFCI breaker manufactured for this purpose - not two single pole GFCI breakers ganged together.
SUBSTANTIATION: There is a lot of confusion in the industry as to how to obtain 240 V GFCI protection - two single pole breakers will not work due to actual current path and two (neutral) grounded conductors.
PANEL ACTION: Reject.
PANEL COMMENT: The substantiation proves that the proposal is unnecessary as the substantiated situation will not work.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2450

2- 180 - (215-10-(New)): Accept in Principle
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for information.
SUBMITTER: Verne Sechler, Electric Light & Power Group
RECOMMENDATION: New text:
Ground fault protection of equipment as specified by 230-95 shall be provided at solidly grounded feeder disconnects when more than 150 volts exists to ground but not exceeding 600 volts phase-to-phase and the feeder's disconnecting means is rated 1000 amperes or more.
Exception: Feeder Ground Fault Equipment Protection is not required when it is already provided as part of the service equipment.
SUBSTANTIATION: The need for ground fault equipment protection for 1000 amp or larger 277/480 grounded system is recognized and required when the service equipment is 277/480 volts. This proposal will require the same needed protection when the service equipment is not 277/480 volts. Past proposals attempted to require these feeder be treated as services in order to achieve this protection, but treating a feeder like a service created many other concerns. This proposal only addresses the feeders equipment ground fault protection needs when it is not provided in the service equipment.
PANEL ACTION: Accept in Principle.
Change to read:

"215-10. Ground-Fault Protection of Equipment. Ground-fault protection of equipment as specified by Section 230-95 shall be provided for a feeder disconnect rated 1000 amperes or more in a solidly grounded wye system with greater than 150 volts to ground, but not exceeding 600 volts phase-to-phase."

Exception: Feeder ground-fault protection of equipment is not required where ground-fault protection of equipment is provided on the supply side of the feeder.

PANEL COMMENT: Change to better correlate with Section 230-95.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9
NEGATIVE: Reign.
NOT VOTING: Sparling.

EXPLANATION OF VOTE:

REIGN: The submitter has given no technical substantiation or documentation to support the need for this proposal and its far reaching cost consequence. The Code must not be permitted to mandate specific requirements when other options may be available to the

user such as insulation of buses which can effectively prevent, or at least retard, arcing ground fault escalation*.

*J. R. Dunki-Jacobs paper "The Escalating Arcing Ground Fault Phenomenon", PCIC-85-3, IEEE Industry Applications Society PCIC Conference Record.

EXPLANATION OF NOT VOTING:

SPARLING: IEEE withholds vote due to lack of consensus.

Log # 683

2- 181 - (215-10-(New)): Accept in Principle
SUBMITTER: Joseph S. Dudor, Midway City, CA
RECOMMENDATION: Add new text as follows:
215-10. Ground-Fault Protection of Equipment. Ground-fault protection of equipment shall be provided for solidly grounded wye electrical feeders of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase for each feeder disconnecting means rated 1000 amperes or more.
(a) Setting. The ground-fault protection system shall operate to cause the feeder disconnecting means to open all ungrounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 1200 amperes and the maximum time delay shall be one second for ground-fault currents equal to or greater than 3000 amperes.

Exception No. 1: The provisions of this section shall not apply to a feeder disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

Exception No. 2: The provisions of this section shall not apply to fire pumps.

(b) Fuses. If a switch and fuse combination is used, the fuses employed shall be capable of interrupting any current higher than the interrupting capacity of the switch during a time when the ground-fault protective system will not cause the switch to open.

(FPN): As used in this section, the rating of the Feeder Disconnecting Means is considered to be the rating of the largest fuse that can be installed or the highest trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted.

(FPN): As used in this section, solidly grounded means that the grounded conductor is grounded without inserting any resistor or impedance device.

(FPN): Where ground-fault protection is provided for the feeder disconnecting means and interconnection is made with another feeder by a transfer device, means or devices may be needed to assure proper ground-fault sensing by the ground-fault protection equipment.

(c) Performance Testing. The ground-fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions which shall be provided with the equipment. A written record of this test shall be made and shall be available to the authority having jurisdiction.

SUBSTANTIATION: With the revision to Section 230-201 made in the 1987 NEC, it is clear that certain circuits that were once classified as services are, in fact, now classified as feeders. Since no justification was given to eliminate ground-fault protection on such circuits, the only remedy is to provide a section here in Article 215 to clearly express the intent of past Code Panels that these high energy, 480 V and 600 V circuits indeed require ground-fault protection. The need for such protection has been amply demonstrated by statistics provided in the past, and as such these statistics will not be repeated here. The wording proposed here is identical to that of Section 230-95; with the change of the word "service" to "feeder" and the deletion of some of the fine print notes. The latter (FPN's) may be added if the Panel believes they are necessary.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 2-180. The FPN's are covered by the reference to Section 230-95.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Reign.

NOT VOTING: Sparling.

EXPLANATION OF VOTE:

REIGN: See my comments on Proposal 2-180.

EXPLANATION OF NOT VOTING:

SPARLING: IEEE withholds vote due to lack of consensus.

Log # 2844

2- 182 - (215-10-(New)): Reject

SUBMITTER: Andre R. Cartal, Middle Department Inspection Agency, Inc.

RECOMMENDATION: New text:

215-10. Feeders in multi-family dwelling occupancies shall not be permitted to enter or pass thru an occupancy that the feeder does not serve unless the feeder is protected by a fire separation with rating equal to the fire separation rating required between occupancies by the applicable building code.

SUBSTANTIATION: Present common practice in multi-family housing is to install a meter stack and service equipment on the end of a building; Feeders are then installed thru the individual occupancies.

The occupancy closest to the meter stack may have 6,8 or more feeders installed across that basement.

A fire or vandalism in that basement places all the feeders at risk.

PANEL ACTION: Reject.

PANEL COMMENT: The overcurrent protection of these feeders will provide for safety.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 591

2- 183 - (220-1, Exception No. 2-(New)): Reject

Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

Exception No. 2 as covered in Article 720.

SUBSTANTIATION: Since the present exception references a section which already may be considered covered by Section 90-3, the proposed exception referencing different voltages is appropriate.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel understands that scope statements are the responsibility of the Correlating Committee.

It is the Panel's intent that Article 220 applies to installations as covered in Article 720 and therefore feels the exception would be improper.

VOTE ON PANEL ACTION: Unanimously Affirmative..

ARTICLE 220 -- BRANCH CIRCUIT AND
FEEDER CALCULATIONS

Log # 2767

2- 184 - (Table 220-3(b)): Reject

SUBMITTER: Paul B. Stephens, Sunnyvale, CA

RECOMMENDATION: Add to

Occupancy type	Unit load per sq ft
	(volt-amperes)

Computer Rooms	30***
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***Unless load calculations support other values

SUBSTANTIATION: Too often people with limited experience approve only limited capability. When computers are installed transformers, feeders and branch circuits are overloaded and fail

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not support the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 224

2- 185 - (220-3(b), Exception-(New)): Reject

SUBMITTER: William R. Morris, JBA Consulting Engineers

RECOMMENDATION: Add the following:

Exception: Where state or local codes or ordinances have adopted energy codes limiting lighting load

Submitted material has been reproduced as received.

See note on Page 1.

volt-amperes per sq. ft. to values lower than those in Table 220-3(b), said values may be used in lieu of the volt-amperes listed in Table 220-3(b).

SUBSTANTIATION: Most model energy codes limit the volt-amperes that can be utilized for lighting to 2 VA or less per sq. ft. Fixtures and lamps are readily available that meet the criteria of 2 VA per sq. ft. while also meeting the recommended lighting levels published by the Illuminating Engineering Society. For a typical 100,000 sq. ft. office building the reduction in VA results in a savings of 150,000 VA of service equipment, transformers, conductors, etc. which is a significant savings in money that does not present a hazard or inconvenience, yet still provide a more than adequate electrical installation.

PANEL ACTION: Reject.

PANEL COMMENT: See Section 90-4. If accepted this requirement would make the NEC apply differently in each local jurisdiction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 186 - (220-3(c)): Accept

SUBMITTER: CMP 2

RECOMMENDATION: Revise last sentence to read:

"Each receptacle outlet, regardless of the number of receptacles, shall be considered at not less than 180 volt-amperes."

SUBSTANTIATION: The Panel believes that for branch-circuit calculation purposes, 180 volt-amperes per receptacle outlet is adequate for unknown loads. The proposed wording should clarify the Panel's intent.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Carpenter.

EXPLANATION OF VOTE:

CARPENTER: The argument that the branch-circuit overcurrent protection would protect conductors from overload may be true but the simple fact remains that the additional receptacles installed in one outlet box are there to connect additional loads. It is becoming more and more common for these receptacles to be used to supply loads that are in use simultaneously thereby quickly exceeding the 180 VA minimum consideration per outlet. For instance an area where a personal computer with its associated equipment is connected to an outlet containing two duplex receptacles or a canteen area where several machines (toasters, microwave ovens, coffee pots, etc.) are connected to ganged receptacles in one outlet box. Even if the designer limits the number of receptacles on a circuit the feeder and/or service could become too small.

Log # 2978

2- 187 - (220-3(c)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: The last sentence should be revised to read as follows:

"For receptacle outlets, each single or each multiple receptacle on one strap shall be considered at not less than 180 volt-amperes."

SUBSTANTIATION: This revision would clarify as improper a recent interpretation of this section which appears in the 1986 TCD and the 1987 Handbook. Consider a ten gang masonry box full of duplex receptacles. Since this box is a single point on the wiring system, we have only one outlet. It is argued that therefore this is a multiple receptacle outlet (in this case a "twenty-plex") and the present wording requires that this outlet be counted in total as 180 volt-amperes. This argument is made even though the same arrangement in ten handy boxes chase nipples together is unquestionably 1800 volt-amperes. When more than one strap is installed, it generally reflects a belief that additional load will be connected.

The proposed wording would settle the issue once and for all. On the floor of the convention in Atlanta, it was argued that there was no problem with the smaller load because the overcurrent protective devices would limit the current to the outlet. This is true, however, it disregards the basic reason for the existence of Article 220: redundancy of protective

provisions. In order to protect conductors from overloads, in general we do two things: we place overcurrent protection at the supply end of any conductor AND we control the permitted load on its load end. Consider an entire house wired on a single 15-ampere branch-circuit. A similar argument would have the Code accept this as a design decision, because the 15 ampere circuit breaker protects the wiring. This is simply not the philosophy underlying either Article 220 or good Code. The Commonwealth of Massachusetts has accepted this language into its version of the 1987 Code by formal amendment.

PANEL ACTION: Reject.

PANEL COMMENT: It is the intention that multiple receptacles in one outlet box be considered 180-volt amperes.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Carpenter.

EXPLANATION OF VOTE:

CARPENTER: See comment on Proposal 2-186.

Log # 2432

2- 188 - (220-3(c)(5)): Reject

SUBMITTER: J. Philip Simmons, State of Washington/Electrical Inspection Section

RECOMMENDATION: Revise section to read as follows:

(5) "Receptacle outlets . . . 180 volt-amperes per receptacle

SUBSTANTIATION: The text should be revised to more logically provide for the distinct possibility that the more receptacle outlets that are installed, the greater the calculated load should be. The present text has been interpreted to mean that a load factor of 180va is to be provided regardless of whether one or ten or more receptacles are installed at an outlet. The proposed text will provide a more logical load calculation and ensure that adequate branch circuits and feeder and service capacity are provided for these outlets.

PANEL ACTION: Reject.

PANEL COMMENT: See Proposal 2-186 and Panel Comment on Proposal 2-187.

The Panel disagrees with the substantiation.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Carpenter.

EXPLANATION OF VOTE:

CARPENTER: See comment on Proposal 2-186.

Log # 3167

2- 189 - (220-3(c)): Reject

SUBMITTER: Robert Picott, Department of Building & Safety, Los Angeles, CA

RECOMMENDATION: Add a general paragraph below paragraph in item No. (5) to read as follows:

General illumination outlets (fixtures) supplying screw shell lamps shall be rated at the maximum wattage rating of the fixture.

SUBSTANTIATION: Previous editions of the Code required rating of general illumination outlets at 180 watts minimum except for electric discharge types. Under the current Code, people are designing systems with lamps at less than the fixture rating; and then when our inspectors review these installations the tenants have increased the lamp wattage ratings to the maximum size noted on the fixture. This has caused problems of overloading circuits and feeders as well as nuisance tripping of overcurrent devices.

PANEL ACTION: Reject.

PANEL COMMENT: The general lighting load for a building is determined by Table 220-3(b) based on the square foot area of the building and is not generally determined by counting the number and wattage of the fixtures. However, if the total connected lighting load of a building is greater than that value determined by Table 220-3(b) then the greater load must be used and this is already required.

The substantiation does not correlate with the proposal.

180 volt-amperes does not apply to general illumination. Section 220-3(c) does not apply to general illumination.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1230

2- 190 - (220-4): Reject

SUBMITTER: Tom Moran, Chagrin Falls, OH

RECOMMENDATION: Revise as follows:

Each bathroom in a dwelling unit must be on a separate, independent 20 amp (or 15 amp minimum) circuit. 1987 Code permits 4 receptacles on the same 15 amp circuit

SUBSTANTIATION: The use of hand held hairdryers and curling irons using up to 1500 watts each makes it dangerous to have 2 hairdryers in 2 separate bathrooms in use at the same time. It is likely most homes have more than 1 hand held hairdryer (but only 1 toaster). The wiring requirement for bathrooms should be upgraded with the increasing use of "appliance" type electrical devices in bathrooms. It is particularly difficult in a household that has several females who attempt to dry their hair simultaneously. The use of 1 bathroom should not be dependent on the use of a 2nd or 3rd bathroom.

"I consulted with (name deleted), Electrical Inspector, (address deleted). He thinks there is merit to this proposal. The proposal comes as a result of a problem in my home, constructed in 1985.

PANEL ACTION: Reject.

PANEL COMMENT: The overcurrent protective device on the branch circuit provides adequate overload protection.

Section 90-1(b) states that the NEC contains provisions for safety.

The proposal is a design consideration.

VOTE ON PANEL ACTION: Unanimously Affirmative.

2- 191 - (220-4(b)): Accept

SUBMITTER: CMP 2

RECOMMENDATION: Delete existing Section 220-4(b) including Sections 220-4(b)(1) and 220-4(b)(2). Add new section as follows:

220-4(b) Small Appliance Branch Circuits - Dwelling Unit. In addition to the number of branch circuits determined in accordance with (a) above, two or more 20-ampere small appliance branch circuits shall be provided for all receptacle outlets specified by Section 210-52 for the small appliance loads.

(Remainder of (b) deleted)

SUBSTANTIATION: To relocate data from Section 220-4(b)-(New) to 210-52(b)-(New) to better match the scope of these two articles.

PANEL ACTION: Accept

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2431

2- 192 - (220-4(b)): Accept in Principle

SUBMITTER: J. Philip Simmons, State of

Washington/Electrical Inspection Section

RECOMMENDATION: Revise Section 220-4(b) to read as follows:

"In addition to the number of branch circuits determined in accordance with (a) above, two or more 20 ampere small appliance branch circuits shall be provided for all receptacle outlets specified by Section 210-54 for the small appliance loads, including refrigeration equipment, in the kitchen, pantry, breakfast room, and dining room of a dwelling unit."

Delete the exceptions and subsection (2).

SUBSTANTIATION: This proposal coordinates with a proposal to create a new Section 210-54. Text relating to where and how the small appliance branch circuits are required to be installed should be located in new Section 210-54.

The scope of Article 220 relates to "requirements for determining the number of branch circuits required and for computing branch-circuit and feeder loads." Text related to where, how and or limitation of branch circuits is not within the scope of Article 220 and should be located in Article 210-branch circuits.

Only text relating to the number of branch circuits and computing branch-circuit load should be located in Article 220 to comply with the National Electrical Code Style Manual.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel Action on Proposals 2-115 and 2-191, has addressed the submitter's intent.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2736

2- 193 - (220-4(b)): Accept in Principle
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Revise the first sentence to
". . . in the kitchen, pantry, breakfast room, dining
room, or similar areas . . .".
SUBSTANTIATION: Same as Proposal 2-110.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: This has been accepted and incorporated
into Proposal 2-115 to Section 210-52(b)-(New).
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3102

2- 194 - (220-4(b)): Reject
SUBMITTER: Paul A. Walach, Donry, NY
RECOMMENDATION: I would like to propose an addition to
change from two appliance to three appliance 20 amp 120
volt circuit with the third circuit to be designated
for a refrigerator, or counter top microwave.
SUBSTANTIATION: In the field I've found that with more
demand in appliances for the smallest galley way type
kitchenetts, even three appliance circuit may not be
enough. Now that GFI's are required by the current
Code in the kitchen next to the sink, this situation
may lead to an electrician wiring in a refrigerator
plug on a GFI. To continue down stream of a small
appliance circuit. (Refrigerator next to the sink)
this situation may cause a nusence to the refrigerator
knocked out by a fault in an appliance operating near
the sink area upstream. The refrigerator could be
turned off & hundreds of dollars in food spoilage could
occur. Furthermore I hope the Code making panel could
at least consider a minimum sq ft rule to warrent
mandatory 3rd appliance circuit in kitchen.
PANEL ACTION: Reject.
PANEL COMMENT: The requirement is for two or more so
there is no prohibition for three.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1244, 2579

2- 199 - (220-4(b)): Reject
Secretary's Note: The Correlating Committee notes
that the Panel Comment does not address the reason for
rejection.
SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter,
I.A.E.I. (1244)
M. E. Avigliano, IAEI Code Clearing Committee (2579)
RECOMMENDATION: Add:
422-7 Space Heating Equipment (other than electric
heat). At least (1) one individual branch circuit of
not less than 15 ampere capacity shall be installed for
the heating equipment. Only those components that are
an integral part of the heating equipment shall be
permitted to be connected to this circuit.
(Renumbr following sections)
SUBSTANTIATION: As the NEC is written, it would be
possible to have lighting and receptacles connected to
the circuit feeding a furnace and its controls, typical
in a residence. Variables associated with cord
connected appliances, extension cords, etc., could
malfunction and cause the complete disconnection of the
heating plant. If this occurred when the resident was
not home, freezing conditions could cause major
damage. It would also be possible to have lights and
the furnace on the same circuit and if the furnace
malfunctioned and tripped the overcurrent device it
would put the furnace and controls in the dark as far
as servicing, belts, motor burn out, themocouple
replacement, etc. Regardless of your area of the
country, if it is important enough to have a furnace,
it is important enough to have it on a dedicated
circuit.
PANEL ACTION: Reject.
PANEL COMMENT: The present Code wording permits this
to be placed on a dedicated branch circuit if desired

or required to be placed on a dedicated branch circuit
if the furnace equipment load requires it.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 592

2- 195 - (220-4(b), Exception No. 4-(New)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add:
Exception No. 4: Receptacles installed to provide
power for electric ignition systems for gas-fired
appliances that are fastened in place.
SUBSTANTIATION: This appears to be a not uncommon
practice and doesn't appear to be any more detrimental
than installing clock outlets or (unlimited) outdoor
receptacles.
PANEL ACTION: Reject.
PANEL COMMENT: The substantiation does not show the
need for the exception.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1279

2- 196 - (220-4(b), Exception No. 4-(New)): Reject
SUBMITTER: Harry E. Leiber, Jr., Great Lakes
Electric Co.
RECOMMENDATION: 220-4(b)(1) - Working Unchanged - Add
Exception # (4)
exception #1 May be used for support of electric
clocks.
exception #2 May be used for support of exterior
receptacles.
ADD EXCEPTION #4 May be used (solely) for support of
a light fixture, when located directly above the
kitchen sink.
SUBSTANTIATION: Since the small appliance circuit(s)
may supply - 1. clocks or 2. exterior receptacles, and
the loading applied to the exterior receptacle, may be
of any loading, connected by extension cord, It is a
useless requirement that the kitchen fixture, when
located over the kitchen sink not be allowed to be
connected to this circuit.
At the very most this fixture would be a 60 watt, or
fluorescent fixture, - representing a load of 0.8 Amp.,
and this load would not be constant.
PANEL ACTION: Reject.
PANEL COMMENT: It is the Panel's intent that the small
appliance branch circuit supply only the small
appliance loads as specified by Section 210-52(b), and
not general lighting loads.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2477

2- 197 - (220-4(b)(2)): Reject
SUBMITTER: Dennis Ackerman, Rockford MI
RECOMMENDATION: Revised text:
(2) Countertop receptacle outlets installed in the
kitchen shall be supplied by not less than "3 three"
small appliance branch circuits
SUBSTANTIATION: Due to the ever increasing electrical
demand of small appliance's such as microwave ovens,
toaster ovens, coffee makers, food processors, and that
most homes or dwelling unit are wired to JUST meet Code
standards
PANEL ACTION: Reject.
PANEL COMMENT: The substantiation does support the
proposal to make the minimum three for all locations.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2979

2- 198 - (220-4(b)(2)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Revise the first sentence to read as
follows:
(2) Countertop receptacle outlets installed in the a
kitchen shall be supplied by not less than two small
appliance branch circuits, either or both of which
shall be permitted to supply receptacle outlets in the
same kitchen and in other rooms specified in (b)(1)
above.

SUBSTANTIATION: This revision is intended to address dwelling units that have two kitchens. Countertop receptacle outlets in each kitchen should not be supplied by the same two small appliance branch circuits; the existence of two kitchens usually reflects a design intent for simultaneous use and the countertop circuits could easily be subject to severe overload without the knowledge of the occupants. These double kitchen installations are common, especially among certain ethnic groups.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that in a dwelling which has two or more kitchens, each kitchen should be wired with two small appliance branch circuits. The proposal would not accomplish what the substantiation intends.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1524

2- 200 - (220-4(b)(3)): Reject

SUBMITTER: Mark Ode, Scottsdale, AZ

RECOMMENDATION: Revise as follows:

(3) Receptacles installed in bathroom areas shall be supplied by not less than one small appliance branch circuit and that circuit shall have no other outlet.

SUBSTANTIATION: With an increased use of hair care appliances such as hair blowers with heat and heated curler devices the 15 amp circuits now supplying not only bathrooms but outside receptacles and garage receptacles are constantly being tripped and reset with the wire suffering the overload problems inherent with this overloading ie: insulation deterioration and stress on the system. We have had numerous problems with this locally.

PANEL ACTION: Reject.

PANEL COMMENT: The receptacles in the bathroom do not qualify under the definition of small appliance branch circuit.

The Panel does not consider a dedicated bathroom appliance circuit to be justified.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 684

2- 201 - (220-10(b)): Accept

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Delete the second paragraph of Section 220-10(b).

SUBSTANTIATION: The second paragraph was added in Proposal 2-167 of the 1987 NEC-TCO on the justification that the original Proposal (2-250 of 1987 NEC-TCR-86-A) would have eliminated this requirement. In fact, this requirement did not exist in the 1984 NEC, and further, sizing of the service conductors properly belongs in Article 230 under Panel No. 4. No justification was given to increase the requirement for service conductors under continuous load, as was pointed out by the negative comments to Proposal 2-167 by Messrs. Cunningham, Lordi and Reign. The requirements for service conductors belong in Article 230, where there has been no proposal submitted previously to increase the size of service conductors in recent years.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2524

2- 202 - (220-10(b)): Accept

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Delete the second paragraph which says "the ampacity of the ungrounded service conductor shall not be less than the noncontinuous load plus 125 percent of the continuous load".

SUBSTANTIATION: There is no justification to require service conductor ampacity to be increased because of a continuous load. This is not required for feeders in

the first paragraph of 220-10(b). Overcurrent devices DO require derating, conductors DO NOT. Ampacity is defined as "The current in amperes a conductor can carry continuously under the conditions of use without exceeding its temperature rating".

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3326

2- 203 - (220-10(b), Exception No. 2-(New)): Reject

SUBMITTER: Banshi Patel, EPE, Inc.

RECOMMENDATION: Renumber existing Exception No. 1:

New Exception No. 2: Dedicated feeder and conductors supplied from storage batteries of 1 hour or less duty cycle can be sized per table 220-10 for Uninterruptible Power Supplies. Overcurrent device to be 100% of the ampacity at maximum discharge current.

(Table 220-10 shown on following page.)

SUBSTANTIATION: Storage batteries providing power to Uninterruptible Power Supply Equipment are limited duty sources. Constant kilowatt load start at higher nominal float voltage with lower current and in one hour or less decreases to a lower (cut-off) voltage at higher current. The inverter will shut off. For sizing, feeders and conductors maximum current at lower (cut-off) voltage is used in the calculations.

Example: UPS is rated for 400KVA/360KW, DC range is 462VDC (nominal float voltage) to 335VDC (cut-off voltage). 90% efficient inverter would need 405KW battery power. At the start the battery discharge current would be 866ADC at 462VDC, and as the voltage would decrease the current would increase. The maximum current value obtained at the lower (cut-off) voltage of 335VDC would be 1194ADC, in order to sustain constant 360KW load. At this point inverter would shut off. Normally UPS has 15 minute battery back-up time. TABLE 220-10 could be utilized to size feeder and conductors. Overcurrent device would be 1200A for 1194ADC maximum current.

Feeder conductor would be as follows for 90°C type THHN wire

- a) 3 Each of 250MCM for 31-60 minute batteries (back-up)
- b) 3 Each of 0000AWG for 16-30 minute batteries (back-up)
- c) 3 Each of 0000AWG for less than 15 minute batteries (back-up)

PANEL ACTION: Reject.

PANEL COMMENT: There is no documentation supplied to support the tables. This is not a continuous load as shown by the proposer. The load varies therefore it should be considered a noncontinuous load.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2293

2- 204 - (220-11 and Table 220-11): Reject

SUBMITTER: Bill Eklund, City of Creston, IA

RECOMMENDATION: Delete from Table 220-11 - categories "Hospitals" and "Hotels" unless special areas are identified.

Clarify feeder calculation procedures using Section 220-10(c) and Table 220-11.

SUBSTANTIATION: We do not know if Section #220-10(c) and Table 220-11 should be combined. (Should one demand factor be applied to reduce feeder load and then use another demand factor to increase feeder load?)

PANEL ACTION: Reject.

PANEL COMMENT: There is no Section 220-10(c). The substantiation does justify deletion of hospitals and hotels. See Panel Action on Proposal 2-202 which deletes the second paragraph to Section 220-10(b).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Table 220-10 Ampacities of Insulated Conductors: Up to Four Conductors in Raceway or Cable Trays** Used with Short-Time Rated Dedicated Storage Batteries.

Max. Operating Temp	75°C			90°C			110°C		
Size AWG MCM	Type MTW, RH, RHW, THW, THWN, XHHW 60 min 30 min 15 min			Type AVB, FEP, FEPB, PFA, PFAH, FHH, SA, TA, THHN, XHHW*, Z 60 min 30 min 15 min			Type AVA 60 min 30 min 15 min		
16	10	12	13	..	..	..	..	..	..
14	25	26	29	31	32	36	38	40	45
12	30	33	37	36	40	45	50	50	56
10	40	43	48	49	52	58	65	65	73
8	55	60	67	63	69	77	80	80	90
6	76	86	96	83	94	105	105	105	118
5	85	95	106	95	106	119	121	121	136
4	100	117	131	111	130	146	147	147	165
3	120	141	158	131	153	171	168	168	188
2	137	160	179	148	173	194	190	190	213
1	143	175	196	158	192	215	215	215	241
0	190	233	261	211	259	290	294	294	328
00	222	267	299	245	294	329	331	331	371
000	280	341	382	305	372	417	413	413	463
0000	300	369	413	319	399	447	440	440	493
250	364	420	470	400	461	516	516	516	578
300	455	582	652	497	636	712	707	707	792
350	486	646	724	542	716	802	809	809	906
400	538	688	771	593	760	851	856	856	959
450	600	765	857	660	836	931	930	930	1042
500	660	847	949	726	914	1024	1004	1004	1125

Other insulations shown in Table 310-13 and approved for the temperatures and locations shall be permitted to be substituted for those shown in Table 220-10. *for dry locations only. See table 310-13. **for 5 or more simultaneously energized power conductors in raceway or cable trays. The ampacity of each power conductor shall be reduced to a value of 80 percent of that shown in the table.

Log # 593

2- 205 - (220-13): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise text as follows:

"The use of demand factors in Table 220-13 shall be permitted for receptacle loads computed at not more than 180 volt-amperes per outlet in accordance with Section 220-2(c)(5)."

SUBSTANTIATION: "Other than dwelling units" is redundant as the heading covers this. Table 220-11 provides demand factors for lighting loads; Table 220-13 provides demand factors for receptacle loads which are NOT lighting loads. Whether derived empirically or arbitrarily the table demands are different. Section 220-11 conflicts with this section in that it specifies that Table 220-11 applies to general illumination which nondwelling receptacles are NOT.

The present wording permits either table to be used for receptacle loads. ("Table 220-11 OR those shown in Table 220-13"), which results in a wide disparity or computed load for the same occupancy and number of receptacles.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel recognizes that Table 220-11 is titled "Lighting Load Feeder Demand Factors" but it is the Panel's intent that the demand factors of Table 220-11 be permitted for receptacle loads computed as specified in Section 220-13.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2930

2- 206 - (220-13): Accept

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Revise to read as follows:

220-13. Receptacle Loads -- Nondwelling Units. In other than dwelling units, receptacles loads computed at not more than 180 volt-amperes per outlet in accordance with 220-3(c)(5) shall be permitted to be added to the lighting loads and made subject to the

demand factors given in Table 220-11, or they shall be permitted to be made subject to the demand factors given in Table 220-13.

SUBSTANTIATION: This proposal intends clarification of exactly how the option of Table 220-11 is to be applied to receptacles in this section. The existing wording lends itself to two conflicting interpretations, first, that the lighting is figured and then receptacle loads are entered at the bottom of the rate block, or second, that the receptacles go into the lighting load to begin with, which usually results in a lower total demand. This proposal makes the second interpretation clear, while continuing to preserve the Table 220-13 option.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1963

2- 207 - (220-15, Exception No. 2): Reject

SUBMITTER: Olaf G. Ferm, Ferm's Fast Finder Index

RECOMMENDATION: Change Exception 2 to read:

In a dwelling unit you may use the same demand factors as permitted in Sections 220-30 and 220-31 for fixed electric space heating loads. In a multifamily dwelling, you may use the same demand factors as permitted in Table 220-32 for fixed electric space heating loads.

SUBSTANTIATION: In its present wording exception 2 does not make it clear if the total calculation has to be made by Sections 220-30 - 220-31 or 220-32 or if the calculation can be made by using 220- B for all calculations except the electric space heating load.

PANEL ACTION: Reject.

PANEL COMMENT: The present Code permits optional use of any of the three sections. The tables are meant to be used only for optional calculation, it is not intended that the demand factors given in Sections 220-30, 220-31 and 220-32 be used when making calculations in Part B.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1952

2- 208 - (220-16(a)): Reject
SUBMITTER: Charles M. Trout, Main Electric Co., Inc.
RECOMMENDATION: Change first sentence by deleting "15-or" from the sentence so that portion will read "supplied by 20 ampere receptacles on 20 ampere branch circuits".
SUBSTANTIATION: Most portable appliances used in the kitchen, such as electric fry-pans, electric coffee makers, toasters, dutch ovens and many others are rated in excess of 1440 watts @ 120 volts. This makes enforcement of Table 210-21(b)(2) "Maximum load amperes for 15 ampere rated receptacles, 12 amperes" impossible for an inspector. Requiring 20 ampere rated receptacles on 20 ampere small appliance circuits in the kitchen will assure compliance with the Code and that properly rated receptacles will service these appliances.
PANEL ACTION: Reject.
PANEL COMMENT: Even though the substantiation has technical merit, the substantiation provides no evidence that the installation is unsafe.
 15-ampere receptacles are tested and listed as being suitable for use on 20-ampere branch circuits.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2981

2- 209 - (220-17, Exception): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Revise the exception to read as follows:
 Exception: This demand factor shall not be applied to electric ranges, clothes dryers, space heating equipment where the heat is directly generated or transferred by electricity, or air conditioning equipment.
SUBSTANTIATION: Consider two oil burner motors side by side, one for hot water and one for hot air. The Code should treat them equally under this section. The exception should only apply to resistance applications or heat pumps.
PANEL ACTION: Reject.
PANEL COMMENT: The substantiation covers a condition where the 75 percent demand factor should not be applied because these loads could be continuous.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 225

2- 210 - (Table 220-19): Reject
 Secretary's Note: The Correlating Committee notes that the Panel Comment does not address the reason for rejection.
SUBMITTER: Stuart W. Parks, New Bern, NC
RECOMMENDATION: Revise Table 220-19, Column "B" to read:
 1 3/4 KW to 3 1/2 KW.
SUBSTANTIATION: 1. Article 220-19 refers to household cooking appliances rated in excess of 1 3/4 KW.
 2. Table 220-19 title refers to household cooking appliances over 1 3/4 KW.
 3. Table 220-19, Note 3 refers to all ranges rated more than 1 3/4 KW.
 4. Table 220-19, Note 5 permits cooking appliances in institutional programs rated over 1 3/4 KW.
 No where in Article 220-19 do I find that you are permitted to use Table 220-19 when calculating a cooking appliance less than 1 3/4 KW. By changing Column "B" of Table 220-19 to read as I have stated above would align it with the notes to Table 220-19 and Article 220-19.
PANEL ACTION: Reject.
PANEL COMMENT: This is already covered in the title.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1961

2- 211 - (Table 220-19, Note 2): Accept
SUBMITTER: Olaf G. Ferm, Ferm's Fast Finder Index
RECOMMENDATION: Change the first two lines to read:
 Over 8 3/4 KW through 27 KW ranges of unequal ratings. For ranges individually rated more than 8 3/4 KW and of different ratings, but none . . . (The rest of the statement to remain as is)

SUBSTANTIATION: In the fourth line of the statement of Note 2 it says (using 12KW for any range rated less than 12KW)

This indicates you may have ranges between 8 3/4 KW and 12 KW in this calculation, but the first two lines indicate otherwise. Note 1 takes ranges over 12 KW through 27 KW and Note 3 takes ranges over 1 3/4 KW through 8 3/4 KW

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2982

2- 212 - (Table 220-19, Note 4): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Add the following sentence to the end of Note 4:
 For branch circuits only, where an appliance subject to this Note contains a motor load, the demand factors given in Table 220-19 shall not be applied to the motor portion of the load unless that portion does not exceed 5 amperes.
SUBSTANTIATION: Cook tops and ranges are being increasingly installed with integral exhaust fans that draw very substantial values of current. The assumptions underlying the traditional demand factors for these appliances, related to the unlikelihood of actual loading equal to the actual rating, should not apply to the motor portion of the load which can operate for extended periods at full load and which cannot be made subject to any diversity on the branch circuit level. They are either on at close to full load, or they are off. Feeders will have diversity, and there is no reason to change the traditional rules for them. There is also no reason to penalize small motors, such as fans in convection ovens.
PANEL ACTION: Reject.
PANEL COMMENT: There is not sufficient substantiation to apply Table 220-19 to the auxiliary motors of cooking appliances.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1253

2- 213 - (220-22): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the fourth line in the second sentence and the first line in the fourth sentence as indicated:
 . . . by 140 percent for "3-wire or" 5-wire, 2-phase systems.
 . . . 4-wire, 3-phase (and) ", 3-wire, 2-phase or" 5-wire, 2-phase systems, a further . . .
SUBSTANTIATION: The neutral conductor sizing guidelines contained in this section for 5-wire, 2-phase systems should be changed to include the neutrals of 3-wire, 2-phase systems because the neutral conductor sizing requirements for both systems are the same.
 The number of 3-wire, 2-phase systems has decreased but the need for safety for such systems has not.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1687

2- 214 - (220-22): Accept
SUBMITTER: S. Griffin, Griffin Electric Co.
RECOMMENDATION: Add word "electronic computer," before words "data processing" in last sentence.
SUBSTANTIATION: The title of Article 645 was revised to include these words.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1300

2- 215 - (220-22): Reject
SUBMITTER: William Winglar, Grandville, MI
RECOMMENDATION: Add the following sentence:
 There shall be no reduction of the neutral capacity in a 3 wire, 208/120 volt feeder served by a 208Y/120 volt system.

SUBSTANTIATION: Because of the vector relationship of the two phases there is no reduction of current in the neutral. The current will always be equal to or larger than the current in the phase conductor with the lowest current.

I have seen plans prepared showing a reduced neutral on such systems. Also, I have seen buildings having the electrical service converted from 120/240 volt to 208Y/120 volt with existing feeders having reduced neutrals being reused.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not apply for phase-to-phase loads which are usually a major portion of the loading on such feeders. The first sentence of Section 220-22 does not permit the feeder load to be reduced beyond the maximum line-to-line neutral load.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1707

2- 216 - (220-22 and FPN): Reject

SUBMITTER: Charles M. Trout, Main Electric Co., Inc.

RECOMMENDATION: Add the following sentence at the end of the section as follows:

There shall be no reduction of the neutral capacity for that portion of the load which is connected to a 3-wire circuit consisting of 2-phase wires and the neutral of a 4-wire, 3-phase wye connected system.

Add the following to the (FPN). See note 10(b) to Tables 310-16 through 310-31.

SUBSTANTIATION: The neutral conductor in a 3-wire circuit consisting of 2-phase wires and the neutral of a 4-wire, 3-phase wye connected system carries the same current as the phase conductors. Note 10(b) to Tables 310-16 through 310-31 supports this. Section 220-22 does not indicate that a neutral capacity reduction is not permitted under these circumstances and the (FPN) reference to Example 5(a), Chapter 9 directs us to an example showing a reduction of neutral capacity for dwelling units served by two phase legs and the neutral of a Multifamily Dwelling served at 208Y/120 Volts, Three Phase.

PANEL ACTION: Reject.

PANEL COMMENT: The first sentence of the substantiation is true only for line-to-neutral connected loads. Line-to-line connected loads do not contribute to any neutral currents. Line-to-neutral loads are covered in the first sentence of Section 220-22.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1254

2- 217 - (220-22, FPN): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the FPN after Section 220-22 as indicated:

... 2(b), (4,) "4(a)," and 5(a), ...

SUBSTANTIATION: Editorial - Example 4 was changed to 4(a) in 1984 as a result of approval action on proposal 2-197 which was submitted by CMP-2.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3373

2- 218 - (220-22(b)-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 220-22, (FPN), add new Section as indicated:

"(b) Neutral Requirements-Multiwire Circuits. Where two or more ungrounded conductors of a multiwire circuit supplying line to neutral load is protected by circuit breaker poles with common polarity (poles connected to the same supply bus/terminal) each such conductor shall have a grounded (neutral) conductor sized in accordance with the applicable provisions of Article 220."

(Re-identify existing Section 220-22 as: (a).)

SUBSTANTIATION: Same as Proposal 2-11.

PANEL ACTION: Reject.

PANEL COMMENT: The circuit referred to is not permitted by Section 210-4 as a multiwire branch circuit.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1043

2- 219 - (220-30): Reject

SUBMITTER: Richard F. Purtell, Sunstream Development Corporation

RECOMMENDATION: Revise as follows:

220-30.T. Optional Calculation - Dwelling Unit. Electric Thermal Storage.

(A) Feeder and Service Load: For a dwelling unit having the total connected load served by a single 3-wire, 120/240 - volt or 208(Y)/120-volt set of service-entrance or feeder conductors with an ampacity of 100 or greater, it shall be permissible to compute the feeder and service loads in accordance with this section, provided that more than 85% of the homes heating needs shall be provided by one or more separately controlled electric thermal storage heating units. Feeder and service entrance conductors whose demand load is determined by this optional calculation shall be permitted to have the neutral load determined by section 220-22.

(B) Loads: Electric loads in the computation of service and feeder sizes shall include the following:

(1) Heating Units: The nameplate rating of fewer than four (4) separately controlled ETS units or 80% of the total nameplate rating of four (4) or more separately controlled ETS units. Alternatively, 65% of the nameplate rating may be used if a demand controller will deactivate at least 35% of ETS heating kVA when total service current levels meet or exceed 85% of the rating of the service and feeders. The demand controller shall not reactivate the shed ETS kVA unless and until total service current will not reach 80% of rating after the reactivation of said heating elements.

(2) 1,500.volt-amperes for each 2-wire, 20-AMPERE small appliance branch circuit and each laundry branch circuit as specified in section 220-16.

(3) Three volt-AMPERES per square foot (0.093 square meter) for general lighting and general use receptacles.

(4) The nameplate rating of all fastened in place appliances, ranges, wall-mounted ovens, and countertop cooking units. Branch circuits for these appliances shall not also be included under item 2.

(5) The nameplate AMPERE or kVA rating of all motors and other low power factor loads. Again, do not duplicate this load under item 2.

(C) Total Feeder and Service Load: The total load shall be the sum of Section 1 plus 100 percent of the first 10 kVA of loads under sections 2 through 5 and 40 percent of all loads beyond 10 kVA under sections 2 through 5.

SUBSTANTIATION: With electric thermal storage (ETS) systems, heating kw is two to three times higher than electric resistance, because twenty fours of heat must be provided in only eight to twelve hours of charge time. Central ETS systems can be as large as 33 to 38.5 kw. Calculations under section 220-30 may allow ETS to pass, because of the 65 percent multiplier, even though current from ETS alone reaches the limits of the service.

For example, a 38.5 kw ETS unit draws 161 AMPS at 240 volts. A 5.5. kw water heater requires 23 AMPS. This only leaves 16 AMPS of margin on a 200 AMP service. However, calculations may allow the 38.5 kw with a 200 AMP service because the 0.65 reduces it to only 25.0 kw (104 AMPS).

Sizing of an electric service for electric thermal storage system using section 220-30 may very well put the owner in an overload condition.

PANEL ACTION: Reject.

PANEL COMMENT: The size of the service should be calculated for the load to be served. If additional capacity is required for this installation, it must be provided according to Section 220-10(a).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2388

2- 220 - (Table 220-30): Reject

SUBMITTER: Leonard L. Johnson, Baltimore, MDRECOMMENDATION: To first sentence in table add the words-

"When applying Section 220-21 to Table 220-30 use the"

The sentence would then read

"When applying Section 220-21 to Table 220-30 use the largest of the following four selections"

SUBSTANTIATION: When this statement was deleted from the 1981 NEC it changed the method of calculation. If you have a dwelling with a split system; heat pump compressor outside and supplemental heat inside in air handler; you only have to use the larger of 100% of compressor or 65% of supplemental heat as it is now written. With this type of system it is possible for both to be operating at the same time depending on the outside temp. so both should be used in calculation. By adding the words to the text it would require both to be added to calculation on this type system as was required in 1981.

PANEL ACTION: Reject.PANEL COMMENT: Section 220-21 cannot be applied to Table 220-30. Noncoincident loads were already considered when Table 220-30 was established.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1802

2- 221 - (220-30(a)): Reject

SUBMITTER: Joel Rencsok, City of Phoenix, AZRECOMMENDATION: Revise Section 220-30(a),

Feeder and Service Load. For a dwelling unit having the total connected load served by a single 3-wire, 120/240-volt or 208Y/120-volt set of service-entrance or feeder conductors "and an overcurrent device" each having an ampacity of 100 or greater, it shall be permissible to compute the feeder and service loads in accordance with Table 220-30 instead of the method specified in Part B of this Article. Feeder and service-entrance conductors whose demand load is determined by this optional calculation shall be permitted to have the neutral load determined by Section 220-22.

Only change is to add "and an overcurrent device."

Note: Added material in quotations.

SUBSTANTIATION: The requirement of this article only requires the "service entrance conductors" and the "feeder conductors" to be rated 100A.

See definition of "service entrance conductors" in Article 100.

See definition of "feeder conductors" in Article 100.

See also Example Calculations Page 70-731, Example No. 2(a).

There is no Code article that requires the overcurrent device to be 100A, only the conductors. This will help clarify the intent of the article.

PANEL ACTION: Reject.PANEL COMMENT: Service overcurrent devices are covered in Articles 230 and 240.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 760

2- 222 - (220-30(b)(3)): Accept

SUBMITTER: Michael G. Owen, Electrical Technology & Consulting ServiceRECOMMENDATION: Revise 220-30(b)(3) to read as follows:

"The nameplate rating of all appliances that are fastened in place, permanently connected, or located to be on a specific circuit, ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and water heaters."

SUBSTANTIATION: The present wording does not provide for the calculation of such appliances as clothes dryers, freezers and other appliances that are NOT FASTENED in place. Note that this proposal is intended to be in similar form with Section 220-32(c)(3).

PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 846

2- 223 - (220-35(3)): Accept in Principle

SUBMITTER: Joseph R. Deegan, Westwood, MARECOMMENDATION: Change word "overcurrent" to "overload".SUBSTANTIATION: See Section 230-90.PANEL ACTION: Accept in Principle.

Change Section 220-35(3) to read:

"The feeder has overcurrent protection in accordance with Section 240-3, and the service has overload protection in accordance with Section 230-90."

PANEL COMMENT: The feeder has overcurrent protection.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2451

2- 224 - (220-36-(New)): Reject

SUBMITTER: Verne Sechler, Electric Light & Power GroupRECOMMENDATION: New text:

220-36 OPTIONAL SERVICE AND FEEDER CALCULATIONS FOR NEW RESTAURANTS.

The service size requirements for a new restaurant shall be permitted to be calculated from the maximum KVA demands of existing similar restaurants and the feeder to the cooking equipment shall not be required to be larger than the service. The service or feeder shall have one overcurrent protective device as required in Sections 230-90 and 240-3.

SUBSTANTIATION: The demand history of restaurants shows that the present National Electrical Code requirements for most restaurants are substantially larger than the actual demands justify. Recent analysis of the demand factors of a number of different types of restaurants located in various parts of the country was done by Electric Power Research Institute (EPRI). The results of a portion of the EPRI study are shown in the attached material. This material shows the maximum demand factor of the 97 restaurants studied was 0.96, the minimum was 0.23 and the average was 0.55. Adoption of the proposal would eliminate this type of oversizing.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.PANEL COMMENT: The data supports the present Code requirement.VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Cunningham, Reign.

EXPLANATION OF VOTE:

CUNNINGHAM: The Code Panel Comment for rejecting this proposal was "The data supports the present Code requirements." The panel studied this proposal, and had a good reason to reject it. However, this data does support Proposal #2-226 from The National Restaurant Association.

The EL&P vote at the Panel meeting was to accept this proposal and to reject the NRA Proposal. I will vote to reject the Panel's rejection of this proposal only to get these comments circulated. I will also vote Negative on the Panel's rejection of the NRA Proposal. The Restaurant Association's Proposal included specific data that does indeed support this proposed change. See my comments on Proposal #2-226.

REIGN: See my comment on Proposal 2-226.

Log # 2322

2- 225 - (220-XX-(New)): Reject

SUBMITTER: J. Russell Hill, Friendly Ice Cream CorporationRECOMMENDATION: New text:

Optional Calculations - Restaurants of Repetitive Design

For new or proposed installations of restaurants of repetitive design it shall be permitted to use the actual KVA demand figures in the calculation of feeder and service entrance load providing the following conditions are met:

1. The maximum demand data from restaurants of that design is available in kVA for a minimum of a one year period.

2. The maximum demand used from the data collected also provides adequate capacity for growth.

3. The equipment, lighting, HVA/C and other service loads substantially correspond to those of the data source.

4. The feeder or service entrance has overcurrent protection in accordance with Section 230-90 and 240-3. **SUBSTANTIATION:** Review of past records indicates the recorded demand factors are considerably lower than those permitted by the National Electrical Code. (Data can be provided upon request.)

PANEL ACTION: Reject.

PANEL COMMENT: Data was not provided.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2633

2- 226 - (220-XX and Table 220-XX): Reject
SUBMITTER: Jim Brown, National Restaurant Association
RECOMMENDATION: New text:

Section 220-XX

Optional Calculation for Loads of New Restaurants

The calculation of a feeder or service load for restaurants shall be permitted in accordance with Table 220-XX in lieu of Part B of this Article provided the following conditions are met:

(1) The feeder or service has overcurrent protection in accordance with Section 230-90 and 240-3.

(2) No feeder of the new restaurant need be larger than the service.

SUBSTANTIATION: The National Research Association in cooperation with the Electric Power Research Institute and the Edison Electric Institute, has undertaken a major data collection effort to find actual connected loads, actual peak demands, and resulting demand factors for a wide range of restaurants in the U.S. This data clearly illustrates that actual demand factors in restaurants decline dramatically as connected loads increase. Although the current National Electrical Code allows demand factors for sizing electric feeders to kitchen equipment, recognizing the effects of diversity across multiple pieces of electric equipment, there is no optional method currently available for sizing service-entrance conductors based on whole restaurant loads. The purpose of this optional method is to apply demand factors to whole restaurant connected loads as a step-function based on total connected load.

Allowing no credit for whole restaurant demand factors leads to the installation of larger service entrances/conductors than necessary.

An added benefit of this optional approach would be to relieve some of the industry's current problems with the 310 tables. Using this optional method, most restaurant conductors would be smaller.

Safety will not be effected by this proposed change. The proposed language references the other applicable portions of the Code to insure that there is sufficient overcurrent protection. It should also be noted that the demand factors for restaurants reported here are based on 15- or 30-minute peak demands; one-hour to three-hour demands would be at least 10% less.

There has been concern expressed that any reduction in the size of service entrances as a result of this optional method of calculation could limit future expansion of electrical load in a given facility. We believe the demand factors proposed here will allow for smaller service entrances while still allowing for reasonable growth as illustrated in this example:

- Assume an all-electric restaurant with connected load of 325 KVA. Current Code would require a 1,200 amp service for this building.
- Apply a demand factor of 0.8_i (based on proposed Table 220-XX). The result is 260 KVA.
- An 800 amp service (288 KVA) would now be appropriate.
- Spare capacity of 28 KVA (or 11%) is still possible at the smaller service entrance size.

The decision of how much allowance for growth is necessary at the time of construction always belongs to the owner. Larger service entrances can always be specified. It is our contention that this optional method allows for reduction of service-entrance sizes where appropriate while still allowing spare capacity for growth.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The data supports the present Code requirements.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Cunningham, Reign.

EXPLANATION OF VOTE:

CUNNINGHAM: The Code Panel Comment for rejecting this proposal was "The data supports the present Code requirements." This was the same reason the Panel rejected Proposal #2-224 by the EL&P Group. However, the panel first studied the EL&P Proposal, which was not as thorough as this one, and had some justification to reject it for this reason.

This proposal from the National Restaurant Association included similar substantiating material that I believe the panel overlooked because of the action on #2-224. The Restaurant Association Proposal included specific data that does indeed support this proposed change. I think if the Panel studies the original supporting material they will see that it does support the Proposal for a new Section 220-XX and the proposed new Table 220-XX.

REIGN: The Panel comment that the documentation supports the present Code requirements is not correct. The supporting data supplied by the National Restaurant Association in cooperation with the Electric Power Research Institute and the Edison Electric Institute for 28 all electric restaurants and 78 combination gas and electric restaurants confirm that the proposed demand factors in Table 220-XX, in fact, are appropriate. Optional calculations for restaurants using these demand factors should be permitted.

Table 220-XX was not included in the proposal received from NFPA and is shown below for information and clarification.

TABLE 220-XX
OPTIONAL METHOD - DEMAND FACTORS FOR FEEDERS
AND SERVICE-ENTRANCE CONDUCTORS FOR NEW RESTAURANTS

Connected Load - KVA (Calculated by Article 220 Demand Factors)	Electric Only Percent	Other Demand Factor Percent
0-325	80	100
325 and larger	50	70

Log # 3301, 3302

2- 227 - (220-XX-(New)): Reject

SUBMITTER: Angus M. Clark, Hardee's Food Systems, Inc. (3301)

Lawrence E. Stahl, Hardee's Food Systems, Inc. (3302)
RECOMMENDATION: New text:

Optional Calculation - Restaurants of Repetitive Design. It shall be permissible to use the actual KVA demand of a restaurant of repetitive design as the feeder or service load provided that the actual KVA demand for a period of one year is available for a restaurant of substantially the same design with regard to heating, ventilation and air conditioning loads, food service equipment loads and any other electrical loads utilized.

SUBSTANTIATION: Review of actual KVA demand data for restaurants on the same design is substantially lower than the demand load calculated using section 220-XX Kitchen Equipment Other Than Dwelling Unit(s). In cases where the billing history of restaurants of the same design is available, it should be permissible to use the actual demand loads to size feeders and services.

PANEL ACTION: Reject.

PANEL COMMENT: Demand data has not been provided.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3303

2- 228 - (220-XX-(New)): Reject

SUBMITTER: Don A. Campbell, Boddie-Noell Enterprises, Inc.

RECOMMENDATION: Optional Calculation - Restaurants of Repetitive Design. It shall be permissible to use the actual KVA demand of a restaurant of repetitive design as the feeder or service load provided that the actual

VOTE ON PANEL ACTION: Unanimously Affirmative.

Note: Supporting Material Available for Review at NFPA Headquarters.

92

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has given no technical substantiation or data for his proposal as required by NFPA regulations.

This proposal is impractical for mandatory application. Given the option of determining demand factor by (1) experience, (2) history or (3) reference to IEEE Standard 241; virtually guarantees a lack of uniformity in every jurisdiction.

The substantiation for this proposal "from IEEE 241" that the diversity factor "of mixed light-and-power feeder is likely to be 1.5 to 2 or more"; and yet, the submitter uses this as a rationale for accepting the proposal?

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Reign.

EXPLANATION OF VOTE:

REIGN: It is obvious Article 220 in its present form does not cover shopping centers, industrial plants, airports, etc. It covers farms, schools, and dwellings. There are no provisions covering load calculation for many of the large power consuming devices of today such as variable speed drives, complex heating and air conditioning systems, and industrial loads such as large rectifiers, furnaces, etc. The proposal provides for loads such as these. These loads are simply not covered by Article 220 in its present state.

Optional Calculation for commercial and industrial installations should be permitted. The Panel comment that optional load computations virtually guarantees a lack of uniform enforcement belies the facts. Optional calculation methods already exist throughout Article 220 and no complaints have been voiced.

Proposed Table 220-36 is derived from IEEE Standard 241 which is a recognized method of calculating loads for these type facilities and should be permitted to be used. Otherwise, the Code is being used to force unwarranted waste of taxpayers money.

Safety is not an issue in this matter. There are adequate safeguards in the existing NEC for both overhead and underground conductors to assure that overheating does not occur when actual loads are utilized.

Log # 854

2- 230 - (220-40(a)): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal with respect to Panel Action on Proposal 2-231. This action will be considered by the Panel as a Public Comment.

SUBMITTER: LaVerne E. Stetson, USDA-Agricultural Research Service and Greg L. Stark, University of Nebraska

RECOMMENDATION: Add sentence:

"Where the dwelling has electric heat and the farm has grain drying systems, Part C of this article shall not be used to compute the dwelling load."

SUBSTANTIATION: During the past seven years recorded electrical demand data has been obtained on randomly selected farms for up to two years per farm. Demand data on 280 different farms have been analyzed for at least one calendar year. Equipment surveys were completed for each farm. Demands were computed using Article 220 with separate calculations using Parts B and D, and Parts C and D. These computed demands were compared with the recorded demands. Computed demands were less than measured demands in all cases except where the dwelling unit had electric heat, the farm had grain drying equipment and Part C was used to calculate the dwelling load. In some of these exceptional cases the measured load was 150 percent of the calculated load. Therefore, if Part C is used for those specific cases, the service equipment will be sized too small for the load.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 853

2- 231 - (Table 220-41): Accept

SUBMITTER: LaVerne E. Stetson, USDA-Agricultural Research Service and Greg L. Stark, University of Nebraska

RECOMMENDATION: Add to sentence beneath Table 220-41.

"Where the dwelling has electric heat and the farm has grain drying systems Part C of this article shall not be used to compute the dwelling load."

SUBSTANTIATION: Same as Proposal 2-230.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 225 -- OUTSIDE BRANCH CIRCUITS AND FEEDERS

Log # 3464

4- 2 - (225-XX-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: John P. Leith, Fairfield, AL

RECOMMENDATION: New text:

All Receptacles regardless of voltage that are outside of any structure shall be on G.F.C.I. also any equipment that is wired direct regardless of Voltage shall be connected to G.F.C.I. that are outside of a structure. This proposal shall include Temporary service- before a structure is built.

SUBSTANTIATION: Safety. Most of G.F.C.I. receptacles are just at Dwellings.

PANEL ACTION: Reject.

PANEL COMMENT: Not within the scope of Panel 4.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1186

4- 3 - (225-1): Reject

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: NEC Correlating Committee

RECOMMENDATION: Revise to read:

This article covers electric equipment and wiring for the supply of utilization equipment located on or attached to the outside of public and private buildings, or run between buildings, other structures or poles on other premises served.

No change proposed for Exception or Fine Print Note.

SUBSTANTIATION: This proposal changes the body of the scope of Article 225 to the 1984 NEC wording. The change made to this section in the 1987 NEC indicates Article 225 covers outdoor electric equipment for other than the supply of utilization equipment, which is in conflict with the scopes of other NEC articles covering equipment that may be used outdoors.

PANEL ACTION: Reject.

PANEL COMMENT: Panel reaffirms our action in the 1987 Code for the scope of Article 225.

The Panel believes the present scope agrees with the title and contents of Article 225.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: I agree with the substantiation of the submitter. I believe it is the responsibility of the NEC Correlating Committee for the scope of an Article. Without correlation an article on service in the 1990 NEC may become an Article on feeders by the 1999 NEC.

Log # 882

4- 4 - (225-1, FPN): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

(FPN): For additional information on medium- and high-voltage wiring, see the National Electrical Safety Code (ANSI C2-1984).

SUBSTANTIATION: To correlate with proposed changes to Article 710 and new definitions of voltage ranges.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has given no technical substantiation or data for his proposal as required by NFPA regulations.

This proposal is impractical for mandatory application. Given the option of determining demand factor by (1) experience, (2) history or (3) reference to IEEE Standard 241; virtually guarantees a lack of uniformity in every jurisdiction.

The substantiation for this proposal "from IEEE 241" that the diversity factor "of mixed light-and-power feeder is likely to be 1.5 to 2 or more"; and yet, the submitter uses this as a rationale for accepting the proposal?

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Reign.

EXPLANATION OF VOTE:

REIGN: It is obvious Article 220 in its present form does not cover shopping centers, industrial plants, airports, etc. It covers farms, schools, and dwellings. There are no provisions covering load calculation for many of the large power consuming devices of today such as variable speed drives, complex heating and air conditioning systems, and industrial loads such as large rectifiers, furnaces, etc. The proposal provides for loads such as these. These loads are simply not covered by Article 220 in its present state.

Optional Calculation for commercial and industrial installations should be permitted. The Panel comment that optional load computations virtually guarantees a lack of uniform enforcement belies the facts. Optional calculation methods already exist throughout Article 220 and no complaints have been voiced.

Proposed Table 220-36 is derived from IEEE Standard 241 which is a recognized method of calculating loads for these type facilities and should be permitted to be used. Otherwise, the Code is being used to force unwarranted waste of taxpayers money.

Safety is not an issue in this matter. There are adequate safeguards in the existing NEC for both overhead and underground conductors to assure that overheating does not occur when actual loads are utilized.

Log # 854

2- 230 - (220-40(a)): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal with respect to Panel Action on Proposal 2-231. This action will be considered by the Panel as a Public Comment.

SUBMITTER: LaVerne E. Stetson, USDA-Agricultural Research Service and Greg L. Stark, University of Nebraska

RECOMMENDATION: Add sentence:

"Where the dwelling has electric heat and the farm has grain drying systems, Part C of this article shall not be used to compute the dwelling load."

SUBSTANTIATION: During the past seven years recorded electrical demand data has been obtained on randomly selected farms for up to two years per farm. Demand data on 280 different farms have been analyzed for at least one calendar year. Equipment surveys were completed for each farm. Demands were computed using Article 220 with separate calculations using Parts B and D, and Parts C and D. These computed demands were compared with the recorded demands. Computed demands were less than measured demands in all cases except where the dwelling unit had electric heat, the farm had grain drying equipment and Part C was used to calculate the dwelling load. In some of these exceptional cases the measured load was 150 percent of the calculated load. Therefore, if Part C is used for those specific cases, the service equipment will be sized too small for the load.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 853

2- 231 - (Table 220-41): Accept

SUBMITTER: LaVerne E. Stetson, USDA-Agricultural Research Service and Greg L. Stark, University of Nebraska

RECOMMENDATION: Add to sentence beneath Table 220-41.

"Where the dwelling has electric heat and the farm has grain drying systems Part C of this article shall not be used to compute the dwelling load."

SUBSTANTIATION: Same as Proposal 2-230.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 225 -- OUTSIDE BRANCH CIRCUITS AND FEEDERS

Log # 3464

4- 2 - (225-XX-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: John P. Leith, Fairfield, AL

RECOMMENDATION: New text:

All Receptacles regardless of voltage that are outside of any structure shall be on G.F.C.I. also any equipment that is wired direct regardless of Voltage shall be connected to G.F.C.I. that are outside of a structure. This proposal shall include Temporary service- before a structure is built.

SUBSTANTIATION: Safety. Most of G.F.C.I. receptacles are just at Dwellings.

PANEL ACTION: Reject.

PANEL COMMENT: Not within the scope of Panel 4.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1186

4- 3 - (225-1): Reject

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: NEC Correlating Committee

RECOMMENDATION: Revise to read:

This article covers electric equipment and wiring for the supply of utilization equipment located on or attached to the outside of public and private buildings, or run between buildings, other structures or poles on other premises served.

No change proposed for Exception or Fine Print Note.

SUBSTANTIATION: This proposal changes the body of the scope of Article 225 to the 1984 NEC wording. The change made to this section in the 1987 NEC indicates Article 225 covers outdoor electric equipment for other than the supply of utilization equipment, which is in conflict with the scopes of other NEC articles covering equipment that may be used outdoors.

PANEL ACTION: Reject.

PANEL COMMENT: Panel reaffirms our action in the 1987 Code for the scope of Article 225.

The Panel believes the present scope agrees with the title and contents of Article 225.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: I agree with the substantiation of the submitter. I believe it is the responsibility of the NEC Correlating Committee for the scope of an Article. Without correlation an article on service in the 1990 NEC may become an Article on feeders by the 1999 NEC.

Log # 882

4- 4 - (225-1, FPN): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

(FPN): For additional information on medium- and high-voltage wiring, see the National Electrical Safety Code (ANSI C2-1984).

SUBSTANTIATION: To correlate with proposed changes to Article 710 and new definitions of voltage ranges.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel feels that the proposed changes by the Ad Hoc Committee on Voltages presents an increased risk and potential hazard to persons exposed to those systems. It therefore must be considered a substantive change in Code requirements and requires substantiation.

The Code Panel recommends returning to Committee as the proposals do not make the NEC easier to understand or improve the marking of electrical equipment.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum, Pollock.

EXPLANATION OF VOTE:

CARRICK: The proposal does not change any operating voltages allowed or covered by the Code. It uses definitions of voltage levels that correlate with other national standards. This Code should and does continue to set the maximum voltage levels allowed for specific installation practices. The panel should accept the work of the Ad Hoc Committee on Voltages in general and carefully review each proposal to ascertain that is has not caused a change in the referenced voltage level.

KASSEBAUM: I think the recommendations of the Ad Hoc Subcommittee on Voltages are appropriate.

POLLOCK: This Proposal should be accepted since it correlates with proposed changes in Articles 100 and 710 and does not present any increased risk or potential hazard to persons.

Log # 883

4- 5 - (225-2): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 13-50. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: In tabulation after "Marinas And Boatyards" add "Medium- And High-Voltage Systems, General . . . 710".

Delete from tabulation "Over 600 volts, General . . . 710".

SUBSTANTIATION: Correlates with proposed change in Title for Article 710.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum, Pollock.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposal 4-4.

Log # 594

4- 6 - (225-4, Exception No. 2-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception No. 2: As permitted in Section 225-19(b) and (c)."

SUBSTANTIATION: The reference section allows uninsulated conductors within 5 feet and appears to conflict with this section.

PANEL ACTION: Reject.

PANEL COMMENT: It is not practical to reference all associated sections. It is already permitted in Sections 225-19(b) and (c).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 595

4- 7 - (225-6(a) and (a)(1), Exception-(New)): Reject

Secretary's Note: The Correlating Committee directs CMP 4 to act on the proposal on its merits as it is Panel 4's responsibility. This action will be considered by the Panel as a Public Comment.

It was the action of the Correlating Committee that this proposal be referred to CMP 7 for information.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Overhead Spans. Open individual conductors . . ."

Add:

"Exception to (a)(1): Where supported by a messenger wire."

SUBSTANTIATION: The words "open individual" and the exception would clarify that (cabled) conductors supported by a messenger wire are not included. In (a)(2) "open individual" and "cables" make this distinction.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in Article 321, which is not in the scope of Panel 4's responsibility.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 596

4- 8 - (225-6(b), Definition): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Delete: "more than 15 feet (4.57 m) apart".

SUBSTANTIATION: Lighting installations suspended between two points less than 15 feet apart would not be "festoon lighting" and would require minimum No. 10 conductors per Section 225-6(a)(1).

PANEL ACTION: Reject.

PANEL COMMENT: The Panel wishes to maintain the present definition of festoon lighting because it adequately expresses the Panel's intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 597

4- 9 - (225-7(b)): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"The ampacity of the neutral conductor shall not be less than the maximum net computed load between the neutral and all ungrounded conductors connected to any one phase of the circuit."

SUBSTANTIATION: Present wording does not specify the neutral to be sized according to the highest phase current which may be imposed. Section 220-22 requires the highest phase current to be computed in sizing FEEDER neutrals and this should apply to the branch circuit neutral of this section.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 598

4- 10 - (225-7(c)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for information.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Delete that portion of the last sentence beginning "where the fixtures are . . ."

SUBSTANTIATION: No limitation on location is imposed on such fixtures installed indoors by Section 210-6(c), and the limitation does not seem warranted in this section.

PANEL ACTION: Reject.

PANEL COMMENT: The present wording is for protection against casual contact by persons not aware of the hazard. This is consistent with other parts of the Code.

Section 210-6(c) permits the use; Section 225-7(c) describes the use.

Elevation increases the risk.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2159

4- 11 - (225-7(c)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 2 for information.

SUBMITTER: Gilbert L. Thompson, Baltimore County Electrical Inspection Division

RECOMMENDATION: Following the word "are" on the next to the last line of this section, insert the words "installed according to 210-6(c) and are"; the rest of the sentence should remain the same.

SUBSTANTIATION: I have presented a proposal to amend Section 210-6(c) to provide restrictions on fixtures and their locations when operating at over 120 volts because of the danger that exists when other than authorized persons have access to the fixtures and integral switches. The proposal calls for labeling to warn persons servicing this equipment and tamper-proof means to assure that only authorized persons will provide the service. It also calls for integral switches not to be readily accessible. If the proposal is accepted for 210-6(c), then this proposal is presented to correlate the change.

PANEL ACTION: Reject.

PANEL COMMENT: The reference to Article 210 is already covered by Section 225-7(a).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2485

4- 12 - (225-7(c)): Reject

SUBMITTER: Michael Banka, Grandville, MI

RECOMMENDATION: Revised text:

(c) 277 Volts to Ground. Circuits exceeding 120 volts, nominal, between conductors and not exceeding 277 volts, nominal, to ground shall be permitted to supply lighting fixtures for illumination of out door areas of industrial establishments, office buildings, schools, stores, and other commercial or public buildings where the fixtures "are at least 8 feet from the ground and" are not less than 3 ft from windows, platforms, fire escapes, and the like.

SUBSTANTIATION: Fixture may get damaged and cause electrification. Mainly for safeguarding of persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: There is not sufficient substantiation to make a change. There is no evidence of problems with fixtures located less than 8 feet.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2983

4- 13 - (225-7(c)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Delete the words "where the fixtures are not less than 3 feet (914 mm) from windows, platforms, fire escapes, and the like."

SUBSTANTIATION: Now that there is no height limitation from grade on fixtures at this voltage in 210-7(c), it is ludicrous to maintain a spacing requirement from building openings. The spacing requirement should become a design consideration. In some cases, servicing of such fixtures is more safely done from a permanent platform rather than from a long ladder. Present requirements in Article 410 provide adequate safety, especially 410-18(a) on grounding, and the new revision to 410-54(b) requiring simultaneous disconnection of all ungrounded conductors by their switching devices.

PANEL ACTION: Reject.

PANEL COMMENT: Typical maintenance procedures present increased safety concerns associated with windows, platforms, fire escapes and the like.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2457

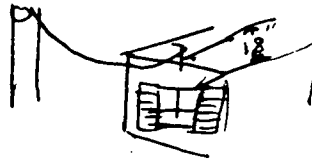
4- 14 - (225-7(c), Exception-(New)): Reject

SUBMITTER: David J. Weenum, Grand Rapids, MI

RECOMMENDATION: Revised text:

Exception No. 1 In circuits exceeding 120 volts nominal between conductors and not exceeding 277 volts nominal to ground a clearance of 18" directly above windows shall be permitted.

SUBSTANTIATION: 120 vac power line brought into the corner of building where window is located



Generally when extending or reaching out is to left, right, straight out or below window.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the 3-foot dimension should be maintained. The substantiation does not adequately support a reduction in the present dimension.

See Panel Comment on Proposal 4-13.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2621

4- 15 - (225-10): Accept

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: In seventh line, add "Liquidtight Flexible Nonmetallic Conduit".

SUBSTANTIATION: It is already permitted for outdoor use per Section 351-23(a)(3).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 599

4- 16 - (225-10, Exception-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: Open wiring on insulators shall be limited as provided in Section 320-3."

SUBSTANTIATION: To alert Code users to the limited use of open wiring on insulators ON buildings per Section 320-3.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that cross referencing is unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2525

4- 17 - (225-11): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Change the title to, "More than One Building or Other Structure", insert the text of Section 230-84 in tact except delete the reference to Section 230-91(b), and add the existing text of 225-11 as paragraph (c), so that the section would read:

225-11. More than One Building or Other Structure.

(a) Disconnect Required for Each. Where more than one building or other structure is on the same property and under single management, each building or other structure served shall be provided with means for disconnecting all ungrounded conductors.

Location shall be in accordance with Section 230-70.

Exception No. 1: For large capacity multibuilding industrial installations under single management, where it is assured that the disconnecting can be accomplished by establishing and maintaining safe switching procedures, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 2: Buildings or other structures qualifying under the provisions of Article 685.

(b) Suitable for Service Equipment. The disconnecting means specified in (a) above shall be suitable for use as service equipment.

Exception: For garages and outbuildings on residential property, a snap switch or a set of 3-way or 4-way snap switches suitable for use on branch circuits shall be permitted as the disconnecting means.

(c) Circuit Exits and Entrances. Where outside branch and feeder circuits leave or enter a building, the requirements of Sections 230-43, 230-52, and 230-54 shall apply.

SUBSTANTIATION: The provisions of Section 230-84 apply to feeders and branch circuits between buildings which are on the premises beyond the service disconnecting means for the premises wiring. These requirements would be more appropriately located in Article 225. Overcurrent protection is covered by Section 225-9.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum, Stricklin.

EXPLANATION OF VOTE:

CARRICK: I disagree with the panel's action on the proposal. The change is appropriate. The correlating committee can see that correlation with other panels is carried out and appoint an Ad Hoc Committee if it sees need. The panel has essentially refused to face the issue.

KASSEBAUM: I disagree with the need for an Ad-Hoc Subcommittee. It is within the jurisdiction of Panel 4 to make this change and refer it to Panel 5, if necessary. It is the Correlating Committee's responsibility to follow through and correlate as necessary with other panels. I think Panel 4 made a procedural error by responding to this proposal in this manner. The change is appropriate and should have been accepted.

STRICKLIN: The time has come to distinguish between feeders and services. The old statement that it is a feeder until it arrives at a building or structure has to end. It is not that hard to separate a feeder from a service. There will have to be coordination between panels in order to do this. This proposal can be a start.

Log # 2984

4- 18 - (225-11): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Delete "230-43,"

SUBSTANTIATION: In the 1987 Code cycle, the provisions of Section 225-10 were extensively revised to reflect modern and customary wiring methods. The cross reference to 230-43, which is a list of wiring methods, is unduly restrictive. For example, if UF cable is run on the outside of a building, it is now literally required to convert to SE cable or some other service wiring method in order to enter the building. This is never enforced, and looking at the discussion in the 1986 TCR, seems to have been an unintended oversight.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum, Stricklin.

EXPLANATION OF VOTE:

KASSEBAUM: I agree with the submitter's substantiation.

STRICKLIN: Same as Proposal 4-17.

Log # 600

4- 19 - (225-13): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert: "or supporting more than 10 pounds of lampholder assemblies" after "(12.2 m)".

SUBSTANTIATION: The weight of lampholders supported should be a factor in requiring messenger wires.

PANEL ACTION: Reject.

PANEL COMMENT: Not sufficient substantiation for the 10-pound limit. No substantiation of a problem.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 884

4- 20 - (225-18): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

225-18. Clearance from Ground. Open conductors at 600 volts or less nominal, to ground, shall conform to the following: . . . (remainder of text unchanged).

SUBSTANTIATION: The hazard involved is with respect to ground. See proposal for FPN.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: This Proposal should be accepted since the substantiation is correct that the hazard is with respect to ground. Also, see my comment on Proposal 4-4.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-21.

Log # 885

4- 21 - (225-18, FPN): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

(FPN): For clearances of conductors at over 600 volts nominal, to ground, see National Electrical Safety Code (ANSI C2-1974).

SUBSTANTIATION: The hazard involved is with respect to ground.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposal 4-20.

COMMENT ON VOTE:

CARRICK: By adding the words "to ground" to this section the line to line voltage can be greater than 600 volts.

Log # 886

4- 22 - (225-19, Heading): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise heading to read:

225-19. Clearances From Building For Conductors of Not Over 600 volts, Nominal, To Ground.

SUBSTANTIATION: The hazard involved is with respect to ground.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposal 4-20.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-21.

Log # 601

4- 23 - (225-19(a)): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"(a) Above Roofs. Conductors shall have a vertical or diagonal clearance of not less than 8 feet (2.44 m) from the roof surface.

Exception No. 1: Where the voltage between conductors does not exceed 300 and the roof has a slope of not less than 4 inches (102 mm) in 12 inches (305 mm), a reduction in clearance to 3 feet (914 mm) shall be permitted for fully insulated conductors.

Exception No. 2: Above roof space accessible to pedestrians vertical clearance shall not be less than 15 feet (4.57 m) for conductors not fully insulated for the operating voltage.

Exception No. 3: Above roof space accessible to vehicular traffic vertical clearance shall not be less than 18 feet (5.49 m).

Exception No. 4: Where the voltage between conductors does not exceed 300, a reduction in clearance above only the overhanging portion of the roof to not less than 18 inches (457 mm) shall be permitted if (1) not more than 4 feet (1.22 m) of the conductors pass above the roof overhang, and (2) they are terminated at an approved above-the-roof raceway or other approved support.

SUBSTANTIATION: The subject of the rule in (a) is NOT FULLY INSULATED conductors which, if at a clearance of more than 10 feet could be covered or bare; if at a clearance of 10 feet or less must be at least covered per Section 225-4. Eight feet is proposed in (a); if 8 feet is suitable for "unfused" service drop conductors per Section 230-24(a) it should be sufficient for feeders or branch circuits with overcurrent protection.

The present Exception No. 1 is not an exception to the subject of (a) but a statement which stands alone.

The present Exception No. 2 "8 feet for INSULATED conductors" is also literally not an exception to the subject conductors of (a).

The present Exception No. 3 extends clearance to 18 feet for the "not fully insulated" conductors of (a) but does not address fully insulated conductors, which by Exception No. 1 could have a clearance of 3 feet.

The present Exception No. 4 permits extended lengths of covered conductors over (sloped) roofs with 3 feet clearance which does not provide adequate safety; such roofs may have permanent ladders or stairs which makes the conductors "readily accessible". Exception No. 5 limits the length of such conductors even if the roof is sloped.

The present Exception No. 5 does not appear to literally permit a raceway installed on the side of a building and extending above the roof, for termination of conductors which may angle across a portion of the overhang. Such installation appears to be equally suitable.

PANEL ACTION: Accept in Principle.

Revise the present Code as follows:

225-19(a) Above Roofs. Conductors shall have a vertical clearance of not less than 8 feet (2.44 m) from the roof surface. The vertical clearance shall be maintained for a distance not less than 3 feet (914 mm) in all directions from the edge of the roof.

Exception No. 1: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of Section 225-18.

Exception No. 2: Same as present Exception No. 4.

Exception No. 3: Same as present Exception No. 5.

(b) Same . . . , shall not be less than 3 feet (914 mm)". delete rest of sentence.

(c) Horizontal Clearances: Clearance shall not be less than 3 feet (914 mm).

(d) Same.

(e) Same.

PANEL COMMENT: The Panel agrees with the submitter on the need to change the vertical clearances to the same as Section 230-24. The Panel sees no need for different clearances for insulated conductors. Further, the Panel feels a horizontal clearance of 3 feet must be maintained from the edge of the roof, with exceptions for termination.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 73

4- 24 - (225-19(a), Exceptions No. 1 and 3): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 4-23. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Re-arrange exceptions as follows:

Existing	Change to
Exception No. 1	"Exception No. 3"
Exception No. 3	"Exception No. 1"

SUBSTANTIATION: Editorial-to conform to the 1984 NEC Style Manual, Part A, A-2(c).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 602

4- 25 - (225-22): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Where exposed to the weather raceways shall be raintight and arranged to drain."

SUBSTANTIATION: All exterior surfaces of buildings may not be wet locations per definition. The proposed wording is similar to Section 250-53.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel intends to require raintight raceways on exterior of buildings regardless of whether it is normally exposed to the weather or not and also require raceways to drain for condensation purposes.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 26 - (225-25): Accept

SUBMITTER: CMP 4

RECOMMENDATION: Change "live" to "energized".

SUBSTANTIATION: Revised to comply with the NEC Style Manual.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 79

4- 27 - (225-26): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlate with the Correlating Committee action on Proposal 4-3. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the heading and the first line in the sentence as indicated:

225-26 (Live) vegetation. (Live) "V"egetation such as trees

SUBSTANTIATION: No vegetation dead or alive, such as trees, should be used for the support of overhead conductor spans or other electrical equipment because of safety considerations. Any lifeless tree is subject to root decay and eventual dislodgment compounded by broken and hazardous electrical lines.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 222

4- 28 - (225-26, Exception No. 2-(New)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: T. David Jones, John Watson Landscape Illumination, Inc.

RECOMMENDATION: Add new Exception No. 2 as follows:

Exception No. 2: Outdoor lighting fixtures and associated equipment installed on trees where supplied by an underground wiring system with the branch-circuit conductors extended up the trees by an approved wiring method.

SUBSTANTIATION: Issued as TIA 70-87-2 by NFPA Standards Council on January 22, 1987.

The adoption of Section 225-26 has inadvertently precluded the continued operation of a recognized specialty industry: Landscape Illumination. Landscape Illumination involves the use of trees for the installation of both security and aesthetic lighting for residential as well as commercial applications.

The original goal of Section 225-26 was the abolishment of overhead conductor spans: i.e. aerials, and not the exclusion of properly installed Landscape Illumination systems.

Over thirty-five years of experience has shown that the use of correctly installed, properly maintained outdoor lighting systems has not been a safety problem. Legitimate companies have met and surpassed all code requirements to date. Section 225-26 has placed these recognized companies in the same category with untrained, inexperienced installers.

The Landscape Illumination industry is characterized by companies that design, install and in some cases manufacture their own equipment. These companies have their equipment UL approved and their installations permitted by local authorities. There is an increasing demand for our product as witnessed by the growth of the industry.

The economic impact of Section 225-26 to these companies is IMMEASURABLE. Section 225-26 will ABOLISH this industry, resulting in unemployment for a multitude of individuals, as well as directly affecting many suppliers.

The acceptance of the proposed amendment will provide direction for correct field interpretation of Section 225-26, thereby providing protection of this legitimate industry.

PANEL ACTION: Accept in Principle.

In the Proposal add "raceway" between "approved" and "wiring method".

PANEL COMMENT: Raceway will provide proper protection for the electrical systems, as well as protection for the person maintaining the vegetation.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Fischer, Munson, Stricklin.

EXPLANATION OF VOTE:

FISCHER: The requirement for "raceway" is too restrictive and is not consistent with present practice which has been accepted as indicated in the substantiation. It will eliminate much of the decorative tree lighting in use today.

MUNSON: The proposal as written will not provide the relief the submitter is seeking.

Article 225 concerns itself with permanently-installed wiring systems in outdoor environments. The conflict occurs when the authority having jurisdiction must judge a permanent wiring system on non-permanent trees.

In order to give the submitter the remedy he seeks this type of wiring should be placed back in Article 305. A specific reference should be made to landscape lighting systems. The permanency issue could be addressed. The authority having jurisdiction would be able to determine the wiring system best suited for its local conditions, and the length of the temporary use. This would ensure that the concerns for safety that the submitter raised would be evaluated.

STRICKLIN: Saw filers in Northern sawmills complain about the different things that have grown into the trees that damage saw blades. In a Southern climate, this growth would be much faster. Safety of life and property is what the NEC is all about. I can't believe that the people that were ingenious enough to come up with landscape lighting couldn't find a better way to install it than on live vegetation.

Log # 2487

4- 29 - (225-26, Exception No. 2-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.

SUBMITTER: J. D. Klug, (No address)

RECOMMENDATION: New text:

Ex 2 String type outdoor lights while not permanent may be used over 90 days provided the vegetation growth does not damage the outdoor lighting.

SUBSTANTIATION: Outdoor decorative lighting should not be required to be removed after 90 days so long as the vegetations growth does not damage the lights

PANEL ACTION: Reject.

PANEL COMMENT: No technical substantiation. This is not a proper exception for Section 225-26. It is more appropriate for Article 305.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2895

4- 30 - (225-26, Exception No. 2-(New)): Accept in Principle

Secretary's Note: See Correlating Committee action on Proposal 4-28.

SUBMITTER: T. David Jones, John Watson Landscape Illumination

RECOMMENDATION: Exception No. 2 to Article 225-26 should read as follows:

Outdoor lighting fixtures and associated equipment installed on trees where supplied by an underground wiring system with the branch-circuit conductors extended up the trees by an approved wiring method.

SUBSTANTIATION: John Watson Landscape Illumination provided material to Panel 4 of the Standards Council (Glen W. Cock - Chairman) which substantiated our claim that our lighting installations conform to National Electrical Code standards. A Tentative Interim Amendment was adopted on January 22, 1987 (attached) and should be incorporated in the 1990 National Electrical Code.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-28.

This proposal is identical to Proposal 4-28 therefore Panel is taking the same action.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Fischer, Munson, Stricklin.

EXPLANATION OF VOTE:

FISCHER: Same as Proposal 4-28.

MUNSON: Same as Proposal 4-28.

STRICKLIN: Same as Proposal 4-28.

Log # 2985

4- 31 - (225-26, Exception No. 2-(New)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: A second exception should be added as follows:

Exception No. 2: Lighting and associated equipment installed on trees where supplied by an underground wiring system. Such equipment and the wiring method supplying it shall be installed on substantial running boards or the equivalent which have been painted or otherwise treated for the conditions and then secured by approved means to the vegetation. The wiring method employed shall be sufficiently flexible for the location.

SUBSTANTIATION: The TIA processed to this section did not address the concerns of either the submitter of the original proposal or the undersigned submitter of a comment. The problem is how trees grow. A staple or a clip secured directly into a tree will not move; the tree over time will expand and drive the cable past the staple shorting out the circuit, or breaking the raceway, or removing the raceway from its supports, etc. This proposal does address those concerns, as well as taking into account the goals of the TIA, which are entirely legitimate.

PANEL ACTION: Reject.

PANEL COMMENT: A running board would be subjected to similar conditions as a staple, or clip, during the growth of the tree.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 230 -- SERVICES

Log # 887

4- 32 - (Diagram 230-1): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise eighth line to read:

"Medium- And High-Voltage Services . . . Part H".

SUBSTANTIATION: Correlates with proposed revision to title of Part H.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

Over thirty-five years of experience has shown that the use of correctly installed, properly maintained outdoor lighting systems has not been a safety problem. Legitimate companies have met and surpassed all code requirements to date. Section 225-26 has placed these recognized companies in the same category with untrained, inexperienced installers.

The Landscape Illumination industry is characterized by companies that design, install and in some cases manufacture their own equipment. These companies have their equipment UL approved and their installations permitted by local authorities. There is an increasing demand for our product as witnessed by the growth of the industry.

The economic impact of Section 225-26 to these companies is IMMEASURABLE. Section 225-26 will ABOLISH this industry, resulting in unemployment for a multitude of individuals, as well as directly affecting many suppliers.

The acceptance of the proposed amendment will provide direction for correct field interpretation of Section 225-26, thereby providing protection of this legitimate industry.

PANEL ACTION: Accept in Principle.

In the Proposal add "raceway" between "approved" and "wiring method".

PANEL COMMENT: Raceway will provide proper protection for the electrical systems, as well as protection for the person maintaining the vegetation.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Fischer, Munson, Stricklin.

EXPLANATION OF VOTE:

FISCHER: The requirement for "raceway" is too restrictive and is not consistent with present practice which has been accepted as indicated in the substantiation. It will eliminate much of the decorative tree lighting in use today.

MUNSON: The proposal as written will not provide the relief the submitter is seeking.

Article 225 concerns itself with permanently-installed wiring systems in outdoor environments. The conflict occurs when the authority having jurisdiction must judge a permanent wiring system on non-permanent trees.

In order to give the submitter the remedy he seeks this type of wiring should be placed back in Article 305. A specific reference should be made to landscape lighting systems. The permanency issue could be addressed. The authority having jurisdiction would be able to determine the wiring system best suited for its local conditions, and the length of the temporary use. This would ensure that the concerns for safety that the submitter raised would be evaluated.

STRICKLIN: Saw filers in Northern sawmills complain about the different things that have grown into the trees that damage saw blades. In a Southern climate, this growth would be much faster. Safety of life and property is what the NEC is all about. I can't believe that the people that were ingenious enough to come up with landscape lighting couldn't find a better way to install it than on live vegetation.

Log # 2487

4- 29 - (225-26, Exception No. 2-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.

SUBMITTER: J. D. Klug, (No address)

RECOMMENDATION: New text:

Ex 2 String type outdoor lights while not permanent may be used over 90 days provided the vegetation growth does not damage the outdoor lighting.

SUBSTANTIATION: Outdoor decorative lighting should not be required to be removed after 90 days so long as the vegetations growth does not damage the lights

PANEL ACTION: Reject.

PANEL COMMENT: No technical substantiation. This is not a proper exception for Section 225-26. It is more appropriate for Article 305.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2895

4- 30 - (225-26, Exception No. 2-(New)): Accept in Principle

Secretary's Note: See Correlating Committee action on Proposal 4-28.

SUBMITTER: T. David Jones, John Watson Landscape Illumination

RECOMMENDATION: Exception No. 2 to Article 225-26 should read as follows:

Outdoor lighting fixtures and associated equipment installed on trees where supplied by an underground wiring system with the branch-circuit conductors extended up the trees by an approved wiring method.

SUBSTANTIATION: John Watson Landscape Illumination provided material to Panel 4 of the Standards Council (Glen W. Cock - Chairman) which substantiated our claim that our lighting installations conform to National Electrical Code standards. A Tentative Interim Amendment was adopted on January 22, 1987 (attached) and should be incorporated in the 1990 National Electrical Code.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-28.

This proposal is identical to Proposal 4-28 therefore Panel is taking the same action.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Fischer, Munson, Stricklin.

EXPLANATION OF VOTE:

FISCHER: Same as Proposal 4-28.

MUNSON: Same as Proposal 4-28.

STRICKLIN: Same as Proposal 4-28.

Log # 2985

4- 31 - (225-26, Exception No. 2-(New)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: A second exception should be added as follows:

Exception No. 2: Lighting and associated equipment installed on trees where supplied by an underground wiring system. Such equipment and the wiring method supplying it shall be installed on substantial running boards or the equivalent which have been painted or otherwise treated for the conditions and then secured by approved means to the vegetation. The wiring method employed shall be sufficiently flexible for the location.

SUBSTANTIATION: The TIA processed to this section did not address the concerns of either the submitter of the original proposal or the undersigned submitter of a comment. The problem is how trees grow. A staple or a clip secured directly into a tree will not move; the tree over time will expand and drive the cable past the staple shorting out the circuit, or breaking the raceway, or removing the raceway from its supports, etc. This proposal does address those concerns, as well as taking into account the goals of the TIA, which are entirely legitimate.

PANEL ACTION: Reject.

PANEL COMMENT: A running board would be subjected to similar conditions as a staple, or clip, during the growth of the tree.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 230 -- SERVICES

Log # 887

4- 32 - (Diagram 230-1): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise eighth line to read:

"Medium- And High-Voltage Services . . . Part H".

SUBSTANTIATION: Correlates with proposed revision to title of Part H.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

4- 33 - (230-2): Reject

SUBMITTER: Armond Webb, Pacific Gas & Electric Co.RECOMMENDATION: Revised text:

230-2. Number of Services. One service shall be installed to each building or other structure on a premise.

Exception: A non-residential, in a multi-building complex, under single management and control, in which the building is a part of a total commercial, industrial, or agricultural production process or function takes place shall be permitted to be electrically supplied by a feeder or branch circuits.

More than one service to a building or structure shall be permitted when in compliance with any of the following exceptions.

Exception No. 1)

Exception No. 2)

Exception No. 3)

Exception No. 4)

Same as present wording in 1987 NEC

Exception No. 5)

Exception No. 6)

Exception No. 7)

When more than one service is installed, a permanent plaque or directory shall be installed at each service drop or lateral or at each service-equipment location denoting all other services on or in that building or structure and the area served by each.

SUBSTANTIATION: The debate over service equipment requirements for multi-building complexes has been raging for years. Various requirements for given multi-building complexes can be interpreted from present Code wording.

This proposal offers some balance and clarity to these requirements. The intent is to require service equipment for all residential units, office type buildings or machine shop, laboratory or other incidental buildings in a multi-building complex which has a major production function or process.

These incidental buildings need service equipment to better protect the building and personnel. But a building which is a direct part of the production function or process should be permitted to be supplied from a designed central electrical service.

PANEL ACTION: Reject.PANEL COMMENT: This is already covered by Section 230-84.VOTE ON PANEL ACTION: Unanimously Affirmative.COMMENT ON VOTE:

KASSEBAUM: I disagree with the substantiation. I think the proposer is confused regarding what constitutes a "service" and what constitutes a "feeder" to a building.

4- 34 - (230-2, Exception No. 4a.): Accept

SUBMITTER: H. Brooke Stauffer, National Electrical Manufacturers AssociationRECOMMENDATION: In 230-2, Exception No. 4a, change "3000" to "2000".

Exception No. 4a would then read, "a. Where the capacity requirements are in excess of 2000 amperes at a supply voltage of 600 volts or less; or"

SUBSTANTIATION: It is not uncommon to have underground services rated 480 V, 3-phase and up to 3000 amperes (i.e., shopping centers, multi-story buildings). The new ampacity tables in the 1987 NEC for underground use do not permit ampacities for a single service rated greater than 2000 amperes. Accepting this proposal would permit two services when 2000 amperes or more is required.

PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 35 - (230-3): Reject

SUBMITTER: Ted Myszak, Alto, MIRECOMMENDATION: Revised text:

230.3 One building or other structure not to be supplied through another. Service conductors supplying a building or other structure shall not pass through the interior of another building or other structure,

but may supply more than one building or other structure on the same property under single management if conditions of 230-91 are met.

(FPN): See Section 230-6 for masonry-encased conductors considered outside of a building.

SUBSTANTIATION: 230-3 does not state that you can supply more than one building through a single service. This proposal will clarify the intent of Article 230-3.

PANEL ACTION: Reject.

PANEL COMMENT: The present Code does not prohibit serving more than one building through a single service. It does prohibit the running of service conductors through a building to serve another building.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 36 - (230-3, Exception-(New)): Reject

SUBMITTER: Tod Billin, Hudsonville, MIRECOMMENDATION: I propose to add an Exception

Exception #1

Where building are under same management it shall be allowed if conductors are protected against physical damage, and leave building at closest available spot

SUBSTANTIATION: In some cases of two buildings under the same management and service disconnecting means is inside building you have to feed from that spot to the other building, or if owner wants disconnecting means for 2nd building inside of the primary building

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent that electrically unprotected service conductors shall not be run through one building to serve another.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 37 - (230-3, FPN): Accept

SUBMITTER: Dan Leaf, Westlake Village, CARECOMMENDATION: Add: "concrete or" between "for" and "masonry".

SUBSTANTIATION: Editorial. "Masonry" generally defines construction units such as brick or block. Section 230-6 uses the phrase "concrete or brick".

PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 38 - (230-6(1)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CARECOMMENDATION: Revise as follows:

"Where installed underground beneath a building or other structure and a minimum 2 inch (50.8 mm) thick concrete pad is placed in the trench over the underground installation."

SUBSTANTIATION: The present wording does not clearly indicate if the conductors are underground or the concrete is on (earth) grade or in a trench. Are conductors installed under a 2 inch raised concrete floor outside the building? A 2 inch concrete slab on grade does not alert persons who may excavate such slabs. "Unfused" service conductors warrant minimum protection of concrete IN the trench, as is specified in Section 300-5(a) Exception No. 1.

PANEL ACTION: Reject.

PANEL COMMENT: The purpose of this section is to define "outside of building" not necessarily to provide physical protection.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 39 - (230-6(1)); 230-28, FPN-(New); 230-79(c);

230-202(i)-(New); 230-204(d); 230-208(b), FPN-(New));

Reject

Secretary's Note: The following proposal consists of Comment 4-19 on Proposal 4-42 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 4-42 was for a complete rewrite of Article 230.

SUBMITTER: Joseph A. Tedesco, J. A. Tedesco Associates, Inc.

RECOMMENDATION: Further revise as follows:

1. In Section 230-6(1) add "installed in raceways" before the word "under."
2. In Section 230-28 add a fine print note to read: (FPN): See Section 810-12 for requirement which prohibits an antenna(s) from being attached to the service mast.
3. In Section 230-79(c) change "10 kW" to "10 kVA."
4. In Section 230-202(i) add "installed in raceways" after "conductors" delete word "placed."
5. In Section 230-204(d) replace "need" with "shall" and "provided" to "required."
6. In Section 230-208(b) (FPN) restructure per NEC Style Manual.

SUBSTANTIATION: Will show compliance with Section 300-5(c), direct attention to an often violated Code rule where antennas are attached to service masts and ignored, correct error, and grammar.

PANEL ACTION: Reject.

- PANEL COMMENT:** 1. Covered by Section 300-5(c).
2. Panel feels that it is unnecessary to add a FPN referencing another section.
3. This is already changed in the 1987 NEC.
4. This was deleted in the 1987 NEC.
5. Panel did not intend this to be mandatory.
6. The FPN was removed in the 1987 NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 232

4- 40 - (230-6(2)): Accept in Principle

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the fifth line of the sentence as indicated:

... raceway that is (enclosed) "encased" by concrete or ...

SUBSTANTIATION: The term "enclosed" should be deleted because the substitute word "encased" provides more meaningful clarity and definition of intent. For example, see FPN following Section 230-3, the asterisk note following Table 300-5 and the third paragraph Section 710-3(b).

PANEL ACTION: Accept in Principle.

In the Code Section 230-6(2) change "enclosed" to "encased in".

PANEL COMMENT: See Panel Action on Proposal 4-37.

This correlates with other parts of the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 605

4- 41 - (230-7): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "service-entrance" to "service".

SUBSTANTIATION: Section 338-1 defines service-entrance cable as a particular specific type. Other types of cables are permitted as service cables and should be included. Sections 230-50(b) and 230-51(b) provide a distinction between "service-entrance" and other types.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1282, 2570

4- 42 - (230-9): Reject

SUBMITTER: Alan B. Cassidy, City of Portland, OR, Bureau of Buildings (1282)

M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2750)

RECOMMENDATION: In Section 230-9, add a new second sentence:

"For this consideration, a window may be either fixed in place, or designed to be opened."

SUBSTANTIATION: Some recent, local interpretations of this exception have found that a "window" is one "which is designed to be opened", as stated in the N.E.S.C. (ANSI C-2). This would allow service heads, service drop conductors, and splices to be mounted within inches of any side of a "window".

I'm sure the Code panel members, when this exception was written into the Code, considered the inherent hazards of persons exposed to the live conductors when washing the windows, or cleaning and painting the sash and trim, or when using the opening as an emergency escape route.

For Code enforcing agencies to sanction the exposing of persons so employed, is doing a great dis-service to our industry, and to the public.

Adding this language should help ensure leaving room to raise and rest a ladder against the wall, and provide safe working space around "windows", without contacting exposed wiring, and sometimes bare or deteriorated insulation on the wires.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that fixed windows are included in the general term "windows" as used in the present section and it is not necessary to restate that in the text of the Code.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: I agree with the substantiation of the submitter. I have been asked the question about fixed or openable windows at all of the meetings on the NEC that I have attended since the 1987 NEC came out. By adding "fixed or openable" after the word window in the present section would clear up this situation.

Log # 2986

4- 43 - (230-9): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: In the second paragraph add after the words "service conductors" the words "installed as open conductors or multiconductor cable without an overall outer jacket".

SUBSTANTIATION: The literal text would now disallow even rigid conduit from crossing below a hayloft door if it contained service conductors. This is absurd, and a careful review of the convoluted history of this new rule casts doubt as to whether this was ever the actual intent of the panel. The apparent intent was more in the direction of making sure that fork lifts, etc. would not encounter drop conductors or other open service conductors in the process of raising materials into the building opening.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that rigid conduit could also sustain damage in these locations.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 606

4- 44 - (230-24): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

Second paragraph: "Service-drop conductors shall not be readily accessible except as may be permitted by Exception No. 2 below, and shall comply with (a) through (d) below for services not over 600 volts, nominal."

(a): "Above Roofs. Conductors shall have a vertical or diagonal clearance of not less than 8 feet (2.44 m) from the roof surface."

Exception No. 1: Where the voltage between conductors does not exceed 300 and the roof has a slope of not less than 4 inches (102 mm) in 12 inches (305 mm), a reduction in clearance to 3 feet (914 mm) shall be permitted for fully insulated conductors.

Exception No. 2: "... and (2) they are terminated at an approved above-the-roof raceway or other approved support"

SUBSTANTIATION: A diagonal clearance should be required for "unused" conductors which may be run parallel to a (flat) roof edge, similar to Section 225-19 which applies to feeders or branch circuits with overcurrent protection.

Roofs covered in Exception No. 2 (which may be flat) may have permanent ladders or stairs which would make such conductors "readily accessible". The limitation of length does not appear to warrant prohibition of such access.

The present Exception No. 3 does not appear to literally permit a raceway installed on the side of a building and extending above the roof, for termination of conductors which may angle across a portion of the overhang. Such an installation appears equally suitable, but not clearly included in "approved support".

PANEL ACTION: Accept in Principle.

Revise as follows:

230-24(a) Above Roofs. Conductors shall have a vertical clearance of not less than 8 feet (2.44 m) from the roof surface. The vertical clearance shall be maintained for a distance not less than 3 feet (914 mm) in all directions from the edge of the roof.

Exception No. 1: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of Section 230-24(b).

Exception No. 2: Same as present Exception No. 1.

Exception No. 3: Same as present Exception No. 2.

(b) Same.

(c) Same.

(d) Same.

PANEL COMMENT: Section 230-24(a) has been revised to include horizontal clearance requirements. The Panel added pedestrian to be consistent with Section 225-19.

Section 225-19 has also been revised so that the vertical and horizontal clearance requirements of both articles will be the same.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 888

4- 45 - (230-24): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: At end of second sentence delete period and add:

" , to ground".

SUBSTANTIATION: The hazard involved is with respect to ground.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposal 4-20.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-21.

Log # 889

4- 46 - (230-24(b)): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: In first sentence, after the word "nominal," add "to ground,"

SUBSTANTIATION: The hazard involved is with respect to ground.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposal 4-20.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-21.

Log # 1189, 3156

4- 47 - (230-24(h)): Reject

SUBMITTER: Earl G. Legacy, Public Service Company of NH (1189)

Richard J. Carnaroli, Electric Council of New England (3156)

RECOMMENDATION: Revise as follows:

Vertical clearance from ground. Service drop conductors where not in excess of 600 volts, nominal, shall have the following minimum clearance from final

grade. 10 feet (3.05 m) - "the portion of the associated service drop span located within 15 feet of the service entrance to buildings and" at the electric service to buildings, or at the drip loop of the building entrance, (or above areas or sidewalks accessible only to pedestrians,) measured from final grade or other accessible surface only for service drop cables supported on and cabled together with grounded bare messenger and limited to 150 volts to ground.

SUBSTANTIATION: The 1987 rewording of this section defeats the original intent of restricting the ten foot clearance to the immediate area of the service entrance.

In the northern areas of the country where snow accumulation occurs, ten feet is not enough clearance in the open. Within fifteen feet of the service entrance, ten feet clearance is generally sufficient, since skiers, snowmobilers, and snowplow operators are reasonably cautious when close to buildings with service entrances; however, at greater distances, ten feet is not enough.

The above suggested change would bring the NEC into close agreement with the National Electrical Safety Code 1987 Edition Table 232-1 Note 8(b).

PANEL ACTION: Reject.

PANEL COMMENT: The problem described by the proposer is a local condition and should be treated accordingly.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2480

4- 48 - (230-28): Reject

SUBMITTER: James M. Jagers, Wyoming, MI

RECOMMENDATION: Revised text:

Service Masts as Supports. Where a service mast is used for support of service-drop conductors, it shall be 1 1/2" rigid metal conduit in size minimum.

SUBSTANTIATION: This article has been left wide open to interpretation. Liquidtight flex or electrical metallic tubing could be used if it were properly supported. I would bet most inspectors would not approve such an installation.

PANEL ACTION: Reject.

PANEL COMMENT: Each service mast has to stand on its own to be able to handle the load imposed upon it.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 607

4- 49 - (230-40): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise text:

"Not more than one set of service-entrance conductors for a single building or structure shall be supplied from each service drop or service lateral."

SUBSTANTIATION: The present wording prohibits one service drop or lateral from supplying service-entrance conductors to (additional) separate buildings.

"Services" for these buildings may be desired due to preference, different rate schedules, occupancies, etc., in lieu of feeders.

This section appears to be the prime prohibition of a single service drop or lateral to supply service equipment in more than one building or structure under single management. Section 230-3 infers this is permissible.

PANEL ACTION: Reject.

PANEL COMMENT: It is unclear what the author hopes to accomplish with this proposal. The proposed text is in contradiction to the substantiation. The present exception permits more than one occupancy to be served from a single service drop or lateral.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Cock.

EXPLANATION OF VOTE:

COCK: I believe the submitter was correct in his substantiation, therefore, the panel should reconsider its action on this proposal.

Log # 2279
4- 50 - (230-40, Exception No. 1): Reject
SUBMITTER: James F. Meehan, New Haven, CT
RECOMMENDATION: Place (,) comma after (one occupancy) and add phrase (which do not have an available space for service equipment accessible to all occupancies) insert (,) comma and continue with rest of exception.
Add (new) second sentence as follows:
Such service sets shall total no more than (6) six sets.
SUBSTANTIATION: Note: Enclosed copy of interpretation No. 288 issued May 16, 1947.

I believe that the intent of these exceptions are to be a safeguard for easy access to the occupants disconnect means. I do not believe that the intent is to have an unlimited number of sets of service-entrance conductors to all such occupants without some restrictions.

With unlimited number of sets of service entrance conductors it can become a nightmare for firefighters who have to fight fires in such buildings and would have to go all over the building to have the separate sets of disconnect means to disconnect energy from the building.

This would also coordinate with Section 230-2, Exception No. 3, which seems to indicate that multiple-occupancy buildings should have a space accessible to all occupancies for service equipment.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.
PANEL COMMENT: This proposal would limit the Panel's intent of allowing one set of service-entrance conductors to be run to each occupancy in buildings with more than one occupancy.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2987
4- 51 - (230-40, Exception No. 1): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Insert at the beginning the words "By special permission, where there is no available space for service equipment accessible to all the occupants."
SUBSTANTIATION: This proposal and the following substantiation appeared in the 1986 TCR and deserve reconsideration:

"As presently written, Exception No. 1 is being used to circumvent the requirement for a main switch ahead of more than 6 disconnecting means. For example, a multiple occupancy of seven units would locate 7 disconnects at the 7 meter location and then run one set of S.E. conductors to the 7th unit. And so on, for 8 or more units."

The panel based its rejection on the idea that the AHJ could disallow under 110-2, by withholding "approval". In most jurisdictions, such an action by the AHJ, of disallowing an installation that met the conditions of the rule, would be overruled as an excessive use of authority. That is certainly true in Massachusetts, which is why the Commonwealth is presently considering making this change in its own Code. This is an entirely legitimate use of the special permission process, and it is entirely consistent with its use in 230-2 Exception No. 3. The panel should also bear in mind that the proliferating disconnects allowed under this rule are not even required to have reciprocal labeling because only one service is involved, and thus 230-2 will not apply.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-50.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2280
4- 52 - (230-40, Exception No. 2): Reject
SUBMITTER: James F. Meehan, New Haven, CT
RECOMMENDATION: In the third line of Exception No. 2 -- delete after (from) the words (one service drop or). This would eliminate the requirements as being applicable to service drop type of services.
SUBSTANTIATION: This would coordinate with Section 230-2 Exception No. 7.

230-2 Exception No. 7 applies only to service laterals, it does not include service drops.

Note: Also included is copy for both proposal for change in 230-40 Exception No. 1 and Exception No. 2, which is interpretation No. 288, issued May 16, 1947, which covers disconnects for multiple occupancy/

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel intends for this exception to apply to service drops as well as service laterals.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 759
4- 53 - (230-41, Exception; 230-41, Exception No. 2-(New)): Reject
SUBMITTER: Michael G. Owen, Electrical Technology & Consulting Service
RECOMMENDATION: A. Change the existing exception of Section 230-41 to "Exception No. 1".

B. Add the following exception:
"Exception No. 2: Bare copper or aluminum bus bars that are an integral part of an approved busway system installed in accordance with Article 364."
SUBSTANTIATION: The present wording does not recognize bare ungrounded conductors. Article 364 states that busways may be used as service-entrance equipment. Addition of this "Exception No. 2" would recognize unisolated bus bars as being suitable for use as service-entrance conductors as per Article 364. Note that Exception No. 5 to Section 230-46 is related to busways.

PANEL ACTION: Reject.

PANEL COMMENT: This is already permitted in Section 230-43(7) and Section 364-2.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1124
4- 54 - (230-41, Exception): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend first line as indicated:
... grounded ("neutral") conductor ...
SUBSTANTIATION: This change is needed to more adequately clarify and simplify the Code meaning/intent because, in accordance with this Code, the neutral and the grounded conductor performs the same/similar functions as indicated in Sections 230-31(c) and 230-42(c). Also, this would do much to minimize confusion and misapplication because in some Code sections the term "neutral" is used and in other sections the term "grounded conductor" is used; for example, in Section 200-2 "grounded conductor" is used and in Section 210-4 "neutral" is used.
PANEL ACTION: Reject.
PANEL COMMENT: The grounded conductor may not be the neutral conductor such as in corner-grounded delta systems.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2883
4- 55 - (230-42, FPN-(New)): Reject
SUBMITTER: Paul E. Phelan, New Hampshire Electrical Contractors Assoc. Inc.
RECOMMENDATION: New text:
FPN For dwelling units see note 3 to the tables 310-16 through 310-31
SUBSTANTIATION: The provisions of note 3 are too important to risk their being overlooked. (I'm not convinced that note 3 doesn't rightfully belong in this section. I have submitted a proposal for a general re-write of note 3 to clear up misunderstandings - copy attached.)

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The reference is repetitious and unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 758

4- 56 - (230-42(a), Exception-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 8 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Michael G. Owen, Electrical Technology & Consulting Service

RECOMMENDATION: A. Add the following exception to Section 230-42(a):

"Exception: The maximum allowable ampacity of approved busways shall be that value for which the busway has been listed or labeled, and in no case shall exceed the ampacity determined in accordance with Section 374-6."

SUBSTANTIATION: The present wording does not provide for the determination or calculation of the ampacity of busways since the ampacities of these busways are not listed in various Tables of Article 310.

PANEL ACTION: Reject.

PANEL COMMENT: Not within the scope of Panel 4. Panel requests that the Correlating Committee send this to Panel 6 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2689

4- 57 - (230-42(a), Exception-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 6 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Thomas E. Purpura, City of Quincy, MA

RECOMMENDATION: After article 230-42 (a) end of paragraph insert the following:

EXCEPTION: In non industrial installations, Table 310-16 shall be permitted to be used for conductors in underground ducts.

SUBSTANTIATION: The 1987 Code Wire Ampacity Tables 310-25 through 310-27, as they apply to services have created problems when interfacing with utility pad mount transformers.

Namely the number of ducts, conductors and terminations in large service installations are in excess of the available space provided in standard pad mount transformers used by utility companies. This has created a situation where a transition point must be installed, such as an enclosure where the conduits and conductors from a service are installed as per 310-25 through 310-27 to the transition point. From the transition point to the utility transformer, conduits and conductors are sized as per utility requirements. This results in fewer ducts and conductors to pad mount transformer.

I feel this introduces unnecessary terminations and negates any added protection of conductors that may be provided by the 1987 Code tables 310-25 through 310-27. In the past table 310-16 ampacities provided adequate protection of conductors in non industrial service installations with no known problems in recent history in this city.

PANEL ACTION: Reject.

PANEL COMMENT: Not within the scope of Panel 4. Panel requests that the Correlating Committee send this to Panel 6 for action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 890

4- 58 - (230-43, Heading): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change heading to:

"Low-Voltage Wiring Methods".

SUBSTANTIATION: To correlate with proposed new definitions of voltage ranges (Article 100 proposals).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as proposal 4-4.

Log # 348

4- 59 - (230-43): Reject

SUBMITTER: John E. Brezan, Lehigh Valley Elec. Insp. Serv.

RECOMMENDATION: New text:

(13) flexible metal conduit not more than 6 feet (1.83 m) long between raceways, or between raceway and service equipment, with equipment bonding jumper installed around the flexible metal conduit according to provisions of Section 250-79(a), (b), (c), and (e). Also see Section 350-2.

SUBSTANTIATION: Service raceways entering structures are many times confronted with permanent obstructions. These conditions create serious installation problems. The problem of making jogs, offsets and excessive use of conduit fittings will be eliminated. Through experience we are not aware of any problems or conditions involving the use of flexible metal conduit and liquidtight flexible conduit. Presently in their use with ac equipment, etc. and proper bonding they have proven to perform safely as raceways. With this fact and the requirements for their proper installation they should be considered suitable for service raceways on the load side of meter equipments to overcome obstructions.

Flexible metal conduit had been used safely as a portion of service-entrance raceway from 1937 until the 1975 edition of the NATIONAL ELECTRICAL CODE. Former subsection 230-63(c) had been eliminated from the 1975 NEC because the wiring method was not listed in Section 230-44 (1971). Recent inquiries at Section meetings of the IAEI indicate flexible metal conduit continues to be used in short lengths to avoid structural protrusions. Flexible metal conduit is particularly useful when making changes or adding to existing service-entrance facilities. The bonding requirement assures low impedance along the path of a possible fault current. Reference to Section 350-2 effectively limits locations for this use of flexible metal conduit.

In 1979 the Panel rejected a similar proposal with a statement that "Bonding accomplishes nothing where a fault occurs within the flexible conduit." In reality, the bonding accomplishes the purpose exactly as conduit couplings (threaded or unthreaded) accomplish bonding integrity in a system of rigid metal conduit or metallic tubing. It is also questionable that the impedance of an arcing fault in 6 feet of metal conduit is substantially different from a similar fault in a 10-foot length of any of the nonflexible metal conduits.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in the present Code. The proposed text is not in accordance with the NEC Style Manual. No substantiation for a change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 359

4- 60 - (230-43): Reject

SUBMITTER: Bob Middleton, Pocatello, ID

RECOMMENDATION: Remove flexible metal conduit as a wiring method for services of 600 volts, nominal, or less.

SUBSTANTIATION: Flexible metal conduit is approved for grounding means if the circuit conductor contained therein is protected by overcurrent devices rated at 20 amperes or less. If a fault happens in the flexible metal conduit, would the flexible metal conduit be able to transfer the fault to the service equipment or meter base? Also, wouldn't you be paralleling the required bonding jumper with the grounded conductor?

PANEL ACTION: Reject.

PANEL COMMENT: The Panel intends to include flexible metal conduit as a permitted wiring method in accordance with Section 230-43(13).

No documentation of a problem was provided.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Flexible metal conduit when shorted out will become a heating element, a red hot heating element, and a perfect fire starter. One thing bonding around the flexible metal conduit does is parallel the grounding and grounded conductors. These conductors may or may not be of the same size, length, or type (aluminum or copper) causing these conductors to also heat up and making them a fire hazard. Service conductors have a very high fault current. With all these things in mind, flexible metal conduit should not be used as a raceway for service conductors.

Log # 1813

4- 61 - (230-43): Reject

SUBMITTER: George B. Wiggin, Lusby, MD

RECOMMENDATION: Revise as follows:

230-43 Wiring Methods for 600 Volts, Nominal . . . : or (13) flexible metal conduit not over 6 feet (1.83 m) long between raceways, or between raceway and service equipment, "with the connectors bonded in accordance with 250-72 (b), (d) or (e)"

Note: Revised material in quotations.

SUBSTANTIATION: The problem with service raceways is to assure that the joints will be able to handle any fault current likely to be imposed so that an arcing fault and burn down does not occur. Bonding around the flexible metal conduit does not provide this assurance. Only by adequately grounding the connectors by bonding or by using wrench tight threaded connections can the arcing fault be eliminated.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the bonding jumper is necessary to provide a low-impedance path.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2435

4- 62 - (230-43): Reject

SUBMITTER: J. Philip Simmons, State of Washington/Electrical Inspection Section

RECOMMENDATION: Revise as follows: Insert the word "or" before the present "(12)" and place a period after "mineral-insulated, metal-sheathed cable".

Revise the present (4) and (13) to be a new second paragraph to read as follows:

"The following wiring methods shall be limited to installation on the exterior of buildings: (1) electrical metallic conduit; and (2) flexible metal conduit not over 6 feet (1.83 m) long between raceways, or between raceway and service equipment, with an equipment bonding jumper installed around the flexible metal conduit according to provisions of Section 250-79 (a), (b), (c) and (e). Also see Section 350-2.

SUBSTANTIATION: We have conclusive evidence that line-to-raceway faults in EMT used ahead of the service have been the cause of building fires. Due to this, and the fact that flexible metal conduit is less capable of containing a line to conduit fault, we have felt obligated to delete these wiring methods by state rule.

At a recent U.L. governmental inspectors meeting, U.L. informed use that these conduit wiring methods are not tested to determine that they will safely contain a line-to-conduit arcing fault. Without such a test to prove such capability, these wiring methods should be limited to use exposed on the outside buildings where the building is less combustible.

Flexible metal conduit for use as a service entrance conductor wiring method was deleted several years ago with considerable documentation. It was restored in the 1987 National Electrical Code with no supporting documentation. Neither EMT nor flex should be allowed inside buildings without conclusive evidence in the form of testing laboratory evidence that they will contain faults which are not uncommon.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is too restrictive and limits these methods to the outside of buildings. No documentation to support the issues mentioned in the substantiation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 80

4- 63 - (230-43(13)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend line 13 as indicated:

. . . (11) Type MC cable; "or" (12) mineral-insulated, . . .

Delete item (13) entirely.

Leave the last sentence unchanged.

SUBSTANTIATION: The amendment to line 13 is a grammatical requirement. Item (13) in Section 230-43 should be entirely deleted because: a) bonding around flexible metal conduit, where used for service raceway, will not safely conduct the high-level fault-current likely to be imposed if/when a fault occurs on or within the raceway(s); b) there is a conflict with Section 250-91(b), item (5) which expressly indicates that the equipment grounding conductor run with or enclosing the circuit conductors shall be permitted to be flexible metal conduit where both the conduit and fittings are LISTED FOR GROUNDING; c) this item (13) does not conform to Section 250-91(b), Exception No. 1: a. and b. where flexible metal conduit is only permitted to be used as an equipment grounding conductor when the length is not over 6 feet and is rated at 20 amperes or less; and d) in Section 230-43(13) flexible metal conduit, in lengths of 6 feet or less, is permitted as a line-side service-entrance conductor wiring method where a bonding jumper is installed around the flexible metal conduit to safely conduct the high-level fault-current likely to be imposed but this does not solve the problem and the reason is this: the 6 feet (or less) of flexible metal conduit MUST STILL BE CAPABLE OF SAFELY CONDUCTING FAULT-CURRENTS OF UP TO 100,000 AMPERES OR MORE BACK TO THE BONDING JUMPER TERMINAL(S) in case of a fault on/within the flexible metal conduit in accordance with Article 110-10 in this Code.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-60.

Panel feels there is no conflict with Section 250-91(b), Exception 1(b) because a bonding jumper is required on circuits exceeding 20 amperes.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-60.

Log # 1808

4- 64 - (230-43(13)): Accept

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: Delete the words "installed around" and replace with "routed with".

SUBSTANTIATION: Correlates with 250-79(e) and really clarifies that spiraling is not permitted.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-60.

Log # 2788

4- 65 - (230-43(13)): Reject

SUBMITTER: Melvin K. Sanders, Ankeny, IA

RECOMMENDATION: Delete this portion covering flexible metal conduit.

SUBSTANTIATION: The only logical location this can be used is outside a building or structure, because 350-2(6) prohibits it being embedded in poured concrete or aggregate and 230-6(2) requires service raceway within a building to be enclosed in concrete or brick. If used outdoors, protection from the elements would be necessary so condensate or water could not enter, or pitched downward so it would drain out of the raceway. The original proposal for the 1987 cycle was to permit liquidtight flexible metal conduit to be used, which made immensely more sense than what actually found its way into the Code.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-60.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-60.

Log # 2620

4- 66 - (230-43(14)-(New)): Accept

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add new #14: "Liquidtight Flexible Nonmetallic Conduit."

SUBSTANTIATION: Section 351-23 (a) (3) permits the outdoor use of this product.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 857

4- 67 - (230-50(a)): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action as to wording and location. This action will be considered by the Panel as a Public Comment.

SUBMITTER: John Jansen, City of Paterson, NJ

RECOMMENDATION: Add sidewalks and walkways to above section. (Where subject to physical damage.)

SUBSTANTIATION: Protection is often not provided for service entrance cable on sidewalks and walkways. We believe the way this is worded in the Code is not very clear to the contractors.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1018

4- 68 - (230-50(a)): Reject

SUBMITTER: Edward C. Levan, Jr., Tonawanda, New York

RECOMMENDATION: Add second paragraph to Section 230-50(a):

"Service-entrance cables that are installed within 10 ft. (3.05 m) of grade level shall be limited to a maximum of 25 ft. (7.62 m) in length."

SUBSTANTIATION: Instead of running service entrance cables from the service point along the eaves or just below the roof line, to where the service entrance cables are run vertically to the meter channel after which on the load side of the meter channel their is 3 ft. (0.91 m) to 4 ft. (1.22 m) of service entrance cable wherein it then enters the building. The service entrance cable is now dropped vertically at the service point to the meter channel. The service entrance cables run from the load side of the meter channel are run at various levels at 2 ft (0.61 m) to 4 ft (1.22 m) above grade level in lengths of 40 ft. (12.2 m) or more. In some instances going around one or more corners. These service entrance conductors are unfused and when damaged to cause a short circuit or a fault will burn until they burn themselves clear. Service entrance cables have been documented to burn their entire length outside of a building until they cleared themselves at the meter channel.

Along with that another hazardous situation that develops with excessive lengths of service entrance cables within a few feet of grade level is due to siding contractors. The siding contractors remove the service entrance cables, install the new siding and do not refasten the service entrance cables. Result is the service entrance cables are left swaying and flopping against the building. When they are low, are left in some cases laying on the ground.

PANEL ACTION: Reject.

PANEL COMMENT: Too restrictive for a permitted wiring method. Improper for this section of the Code. See Section 230-43.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 608

4- 69 - (230-50(b), Exception-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: Type MI and Type MC cable shall be permitted within 10 feet (3.05 m) of grade level where not exposed to physical damage or where protected in accordance with Section 300-5(d)."

SUBSTANTIATION: The present wording in effect prohibits the use of these cables for service-entrance or service lateral conductors. The construction of these cables indicate they should be equally suitable as (Type SE) service-entrance cable.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in the present Code. See Section 230-43.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 891

4- 70 - (230-51(c)): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: At end of second sentence add:

... "with a minimum clearance of 2-inches between a conductor and a surface."

At end of third (last) sentence add:

... "with a minimum clearance of 1-inch between a conductor and a surface."

SUBSTANTIATION: As indicated in the 1987 NEC, Table 230-51(c) the clearance from surface is dependent only on whether or not the conductors are exposed to weather. The system voltage and length of span has no effect on the required clearance. Table 250-51(c) is voltage and span length dependent, therefore the clearance from surface does not belong in that table. Those dimensions have been deleted from the table and inserted in the text of Section 230-51(c).

PANEL ACTION: Reject.

PANEL COMMENT: The Panel feels the table is more appropriate and more easily understood.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: This Proposal should be accepted since the substantiation is correct. This Proposal, if adopted, would clarify the requirements and make Table 230-51(c) easier to understand and apply.

Log # 892

4- 71 - (Table 230-51(c)): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise heading of first column to read:

"Maximum Service Volts" + Delete heading "From Surface" and last column.

Add (+) note: For supports and clearances between conductors of services over 600 volts, see National Electrical Safety Code (ANSI C2-1984).

SUBSTANTIATION: See substantiation for proposed revision to Section 230-51(c). The (+) Note is added to cover services between 601-1000 volts.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4. The Panel believes the table is more appropriate and more easily understood.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Pollock.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposals 4-4 and 4-70.

Log # 609

4- 72 - (230-53, Exception-(New)): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: As permitted in Section 350-2."

SUBSTANTIATION: For consistency and to avoid conflict with Section 350-2; that section is referenced in the exception to Section 225-22 and Section 230-43.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2737

4- 73 - (230-54(c)): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Add to the first sentence:
... "and mounted in a vertical or near vertical position."
SUBSTANTIATION: This addition will clarify that a service head can not be mounted at a slanted or horizontal position which invites non-raintight seepage inside the service cable and down into the meterbase or service equipment terminals.
PANEL ACTION: Reject.
PANEL COMMENT: No documentation of a problem was provided. This issue should be addressed by the authority having jurisdiction. These devices should be installed in accordance with the manufacturer's instructions.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2988

4- 74 - (230-54(c)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Revise to read as follows:
(c) SERVICE HEADS ABOVE SERVICE-DROP ATTACHMENT.
Service heads, and goosenecks in service-entrance cables shall be located directly above the point of attachment of the service-drop conductors to the building or other structure.
SUBSTANTIATION: This proposal makes two changes in the existing text. First, it inserts a comma after "service heads" so as to clarify that the rule applies to any service head whether on cable or raceway. Second, it inserts the word "directly" which clarifies the correct application of the exception. The rule and exception have frequently been interpreted as follows:
1. The head must be above (read: at a greater vertical distance from grade) and at any convenient distance from the point of attachment, even 6 feet; OR
2. The head need not be above (read: at a greater vertical distance from grade) the point of attachment where the higher elevation is impractical, but in this case the horizontal separation may not exceed 2 feet.
The adverb "directly" can only refer to horizontal displacement, and thus the proper application of the rule becomes clear.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-73.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2738

4- 75 - (230-54(f)): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Add a new last sentence:
"At least 3 feet (0.91m) of free service-entrance conductor shall be left at the service head to facilitate proper drip loop forming."
SUBSTANTIATION: This addition will coordinate the N.E.C. service requirements with those of the serving utilities. Drip loop formation requires workable free lengths of conductors for proper and safe splicing.
PANEL ACTION: Reject.
PANEL COMMENT: Should be left up to local utility regulations.
VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 76 - (230-55, 230-62, 230-62(a), 230-62(b), 1st and 2nd sentences, 230-78, 230-203, 230-204(a), Exception): Accept
SUBMITTER: CMP 4
RECOMMENDATION: Change "live" to "energized".

SUBSTANTIATION: To comply with the NEC Style Manual.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 81

4- 77 - (230-62(b)): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the last line in the second sentence as indicated:
... or sealing doors (giving) "providing" access to live parts.
SUBSTANTIATION: The word "providing" will improve clarity and conform to the phraseology used elsewhere in this Code.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 852

4- 77A - (230-63(a)-(New)):
Secretary's Note: Although this proposal was not acted upon by the Panel on the basis of noncompliance with Section 10-10 of the Regulations Governing Committee Projects, the Correlating Committee believes the proposal does comply with those Regulations. The Correlating Committee directs the Panel to act on this proposal on its merits. This action will be considered by the Panel as a Public Comment.
SUBMITTER: David Shapiro, Safety First Electrical Contracting, Consulting and Safety Education
RECOMMENDATION: 230-63(a) (ADD)
Panelboards may be considered directly associated with service equipment when they are in the same room as the service equipment, and connected to the service equipment enclosure by rigid or intermediate metal conduit, conduit bodies, wireways or auxiliary gutters bonded as service equipment in accordance with Section 250-72.
SUBSTANTIATION: For the 1990 NEC I would like to propose that "floating neutrals" not be required in subpanels directly associated with service equipment and connected so as to constructively form part of the equipment. Inasmuch as in that circumstance there is no substantive increase in danger of imposing a voltage on grounded equipment, I can see no argument against this simplification of installations.

Log # 82

4- 78 - (230-65): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the Section as follows:
230-65. (Available) Short-circuit (Current) "withstand rating". "The short-circuit withstand rating of" service equipment shall (be suitable for the) "not be less than the maximum fault-current available" at its terminals. "The short-circuit withstand rating shall be plainly marked on the panel board."
SUBSTANTIATION: The time/need for amending this Section to meaningfully address the problem is long overdue. The existing wording does not clearly define the intent which is explained in Article 110-10. And, for example, electrical equipment may have fuses/circuit breakers rated to interrupt 100,000 A but unless the equipment has a short-circuit rating equal to 1,000,000 A, a short circuit could endanger lives and cause widespread property damage.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel believes the present wording is correct and is in agreement with the service equipment marking requirements.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3331

4- 79 - (230-70, 230-70(a)): Reject
SUBMITTER: S. Zackerman, Cincinnati, OH
RECOMMENDATION: Under 230-70. General, and 230-70(a) Location, make the following changes:
a. Under 230-70. General, revise the words "service-entrance" to read "service".

b. Revise 230-70(a) Location, to read:
The service disconnecting means shall be installed either inside or outside of a building or other structure at a readily accessible location. Where installed inside the building or other structure, the service disconnecting means shall be located nearest the point of entrance of the service-entrance conductors.
SUBSTANTIATION: Definitions in Article 100 indicate that there may be no "service-entrance" conductors where service equipment is located outside the building walls. Obviously, when there is no service-entrance (to a building or other structure), there can be no "point of entrance" (to a building or other structure).
PANEL ACTION: Reject.
PANEL COMMENT: Part (a) was rejected because the submitter's concerns are taken care of in the definitions.

Part (b) was rejected because the Panel's intent is to require an inside disconnect be readily accessible.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Herbert, Pollock.

EXPLANATION OF VOTE:

HERBERT: I agree with the submitter. I believe his proposal clarifies the intent of the Code.

POLLOCK: This Proposal should be adopted since the substantiation is correct. This Proposal, if adopted, would clarify the requirement by removing ambiguous wording.

Log # 233

4- 80 - (230-70, FPN-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first line in the sentence as indicated:

... to disconnect all "ungrounded" conductors in

After the first sentence in Section 230-70, add as indicated:

"(FPN): See Section 230-74 for individual disconnects."

SUBSTANTIATION: Where life-safety is involved, the requirement/intent should be more meaningfully defined.

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent that all conductors be able to be disconnected in accordance with Section 230-74 and Section 230-75.

The Panel believes that the proliferation of cross references is unnecessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 610

4- 81 - (230-70(a)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure, or inside nearest the point of entrance of the service conductors."

SUBSTANTIATION: Editorial. The phrase "nearest the point of entrance of the service conductors" has no meaning where the disconnecting means (and overcurrent devices per Section 230-91(a)) is installed exterior of the building, as the load side conductors are then feeders or branch circuits, yet the phrase is applied to such exterior disconnecting means.

PANEL ACTION: Reject.

PANEL COMMENT: The current wording adequately expresses the Panel's intent.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

NEGATIVE: Herbert, Kassebaum, Pollock.

EXPLANATION OF VOTE:

HERBERT: I believe the proposal better defines the location of the service disconnecting means.

KASSEBAUM: I agree with the substantiation.

POLLOCK: Same as Proposal 4-79.

Log # 2436

4- 82 - (230-70(b)): Accept in Principle

SUBMITTER: J. Philip Simmons, State of Washington/Electrical Inspection Section

RECOMMENDATION: Add a new second sentence as follows:

"Equipment used as the service disconnecting means shall be identified "suitable for use as service equipment" or equivalent."

SUBSTANTIATION: Language similar to this was in several editions of the National Electrical Code until removed from the 1987 NEC. We have inspected several installations that did not comply with the requirements in the U.L. standard for service equipment. Without this requirement in the Code, it is difficult for the electrical inspector to enforce the safety and performance elements such as wire bending space and grounding and bonding capability.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2739

4- 83 - (230-70(c)): Accept in Principle

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Revise the first sentence:

"Each service disconnecting means shall be suitable for use as service equipment and suitable for the prevailing conditions."

SUBSTANTIATION: The term of "suitable for use as service equipment" was deleted from Section 230-70(b) of the 1984 NEC. This is a useful term to authorities having jurisdiction and should be reinserted into Section 230-70(c) where it rightfully belongs.

PANEL ACTION: Accept in Principle.

In the proposal add "identified as" following "shall be" also add "shall be" between "and" and "suitable".

PANEL COMMENT: The Panel believes the service equipment should be identified.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2693

4- 84 - (230-70(d)-(New)):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

SUBMITTER: Robert M. Milatovich, Southwestern Section International Association of Electrical Inspectors

RECOMMENDATION: Add 230-70(d)

480 or 480/277 volt multimeter installations shall have a single disconnect for all meter sockets.

SUBSTANTIATION: 480 or 480/277 volt services with multimeter sections are being installed that do not contain all of the meter sockets and breakers (especially in shell type building).

The pull and meter sections are listed and approved by U.L. as a complete unit, i.e., one of two, two or two, etc.

At the March meeting of the Southern California Chapter of the I.A.E.I. at least one of the major manufacturers stated they would not ship a multimeter section without all of the meter sockets; however, some would.

In order to install additional meter sockets requires contacting the local utility to de-energize the service and possibly shutting down adjacent businesses. This is usually done after hours or on week-ends.

Because of this, as new meter sockets are needed, they are usually installed without de-energizing the service. This is a very dangerous practice, especially with 480/277 volt services as a short will usually cause an arcing fault.

On or about February 2, 1987, at 4476 Dupont Court in the city of San Buenaventura, a contractor was installing a meter socket in a 480/277 volt energized service and apparently shorted a hot bus to ground, resulting in an arcing fault injuring the electrician, causing him to be transported to a burn center with severe burns to his hands, face and chest. (Documentation and pictures of the service are in our files).

Consulting with other jurisdictions and utility companies, I find this potential hazard is of concern and a common problem.

Requiring a service disconnect for 480 or 480/277 volt multimeter sections would correct this problem.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Carrick, Cock, Davis, Fischer, Hunter, Kassebaum, Pollock, Stricklin.

EXPLANATION OF VOTE:

CARRICK: The proposal, as written, does not solve the problem. The addition of a disconnecting means for each meter socket is required to provide an opportunity to install additional meter sockets without deenergizing the other loads on the multimeter installation.

COCK: [230 - 70(d)] - (new) There should be an exception to allow up to 6 disconnects as per section 230-71.

The term "Multimeter" may also include two or more separate meters grouped together in the same location and may NOT be limited to multimeter "sections" as discussed by the submitter.

DAVIS: This proposal does not agree with the substantiation. The proposal should read; There shall be a disconnect ahead of all 480 volt or 480/277 volt services utilizing self-contained meters.

FISCHER: The proposed requirement for a main disconnect will not solve the problems indicated as the building management is still faced with the problem of shutting down other businesses to add an additional meter socket. The wording of the proposal is confusing and could be interpreted to require a service disconnect ahead of each meter socket whereas communication with the submitter indicated the intent is to require a single disconnect regardless of the number of meters.

HUNTER: The wording of this proposal is unclear as to whether the submitter is requesting one single disconnect to deenergize all sockets of a multimeter installation, or whether he is requesting individual disconnects for each socket.

KASSEBAUM: The installation of a single disconnect for all meter sockets (collectively) would still result in either all adjacent businesses involved being shut down by the single disconnect or require the utility to deenergize the service, in order to not install additional meter sockets while the service is energized. The solution that best suits the concerns expressed in the substantiation and doesn't require the utility to be involved, is a single disconnect for each meter socket.

POLLOCK: This Proposal does not address the hazard identified in the substantiation. The hazard discussed occurs when someone works on Service Equipment while it is still energized, specifically to add an additional meter socket.

However, this Proposal requires a multimeter installation to have a single disconnect ahead of all meter sockets. The Proposal does not require a disconnect if the Service Equipment is shipped with one meter socket installed and provision for up to five additional field added meter sockets which is what the Proposal is supposed to address.

The Proposal also requires a disconnect for Service Equipment that is shipped with all meter sockets installed and no provision for additional field added meter sockets. There is also no distinction made between self-contained and current transformer installations.

The contractor discussed in the substantiation was apparently reluctant to contact the utility to have the service de-energized. He may be just as reluctant to use the single disconnect to turn off power to all the other customers in the building.

In addition this single disconnect will now become the service disconnect. The provisions in Section 230-71 and 230-72 allowing up to six service disconnects will no longer apply. Also, there may not be a disconnect provided on the load side of the meter socket since these conductors will now be considered feeders supplying the branch circuit overcurrent devices. This may result in the single disconnect being turned off every time someone needs to add a branch circuit overcurrent device.

While I agree that there is a hazard which occurs when working on Service Equipment while it is energized, I do not see how this proposal addresses the hazard and reduces the potential for injury.

STRICKLIN: The proposal does not agree with the substantiation. The proposal should read; 480 or 480/277 volt multimeter installations shall have a single disconnect ahead of each meter to agree with the substantiation.

Log # 1287

4- 85 - (230-71, Exception No. 2-(New)): Reject
SUBMITTER: Charles Wm. Swathwood, Jr., Babsco Electric Supply

RECOMMENDATION: Add new text as follows:

Exception #2 In multi-family dwellings, with six occupants a seventh disconnect may be installed to supply a "house panel", that distributes the load to outside security lighting, hallway, emergency, and exit sign lighting. This disconnect shall in no case be larger than the occupants disconnect and shall be grouped with the others.

SUBSTANTIATION: There are many six unit apartments and town houses being constructed and also there are many older homes being remodeled into six unit apartment buildings. The house load in these buildings is a very small lighting load, that for the most part is used for secondary and egress lighting. It seems that the added expense of a main disconnect ahead of all of the tenant disconnects because of a house panel would be of no practicability.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel reaffirms the rule limiting the disconnects to 6 at any one occupancy. Present Code permits alternate methods to accommodate the "house panel" such as Section 230-40, Exception No. 1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 360

4- 86 - (230-71(a)): Reject

SUBMITTER: Chris Martin, Eastern Div. Idaho Chapter - IAEI

RECOMMENDATION: Rewrite last sentence to read:

There shall be no more than six service disconnects grouped in any one location.

SUBSTANTIATION: With the present wording of 230-71(a), when more than one service is allowed by exceptions to 230-2, there is no limit to the number of service disconnects allowed in one location.

This proposal would clarify that you may have six disconnects per service but where more than one service is installed at the same location, only six service disconnects would be allowed at that location.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel reaffirms its intent to allow 6 disconnects per service.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1053

4- 87 - (230-71(a)): Reject

SUBMITTER: Bob K. Middleton, Pocatello, ID

RECOMMENDATION: Revise as follows:

The service disconnecting means for each service permitted by Section 230-2 or for each set of service-entrance conductors permitted by Section 230-40, Exception No. 1, shall consist of not more than six switches or six circuits breaker mounted in a group of separate enclosures. (Remainder to remain the same)

SUBSTANTIATION: It's as easy to overload a main lug panel used as service equipment as it is a lighting and appliance branch-circuit panelboard. This wording would require a main disconnect in all panel boards used as service equipment.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the proposal would unnecessarily limit the flexibility needed to accommodate various types of service configurations.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2776

4- 88 - (230-71(a)): Reject

SUBMITTER: Tomas F. Menendez, City of Miami, FL
RECOMMENDATION: There shall be no more than six disconnects per service grouped in any location.
(delete: per service)

SUBSTANTIATION: The way art # 230-71 is written you can have an unlimited number of disconnect in every location.

According to 230-71- (b) you are supposed to disconnect all conductors of the service with no more than six operations of the hand.

If you have 10 "service" in a room, you will need 60 operations of the hand plus the confusion of how many disconnects to disconnect, no matter how good are marked.

Since 1982 all Municipalities, in Dade County agreed to allow six disconnects maximum in any location.

For special conditions, we will always have 230-2 exc # 4-C

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-86.

The number of services is controlled by the authority having jurisdiction. See Section 230-2, Exceptions No. 3, 4, and 5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 808

4- 89 - (230-71(a), FPN-(New)): Reject

SUBMITTER: Sam Grossman, Saddle Brook, NJ

RECOMMENDATION: Add

FPN: In a building or structure with more than six (6) individually metered services served by one service drop, a main disconnect ahead of all meters shall be required.

SUBSTANTIATION: The interpretation of the six disconnect rule when applied to a single service drop serving more than six meters has come up when the meters are assembled on the site and are not a pre-fabricated unit. It has been argued that the rule only applies to the individual meters and the number of disconnects serving each meter.

PANEL ACTION: Reject.

PANEL COMMENT: A FPN is not mandatory. See Section 110-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1727

4- 90 - (230-71(a), FPN-(New)): Reject

SUBMITTER: William A. Anderson, Jr., Bellevue, WA

RECOMMENDATION: Add a (FPN) to 230-71(a) that would read as follows:

(FPN) Location, is an area sufficiently separated to be easily distinguished from other installations.

SUBSTANTIATION: There is seldom a time when Section 230-71(a) is discussed that the question of what a location is meant to accomplish.

This would provide a common ground for both the installer and the enforcer.

PANEL ACTION: Reject.

PANEL COMMENT: Does not provide clarity. The definition of "location" must be decided by the authority having jurisdiction. "Easily distinguished" is vague and undefined.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1255

4- 91 - (230-71(b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the fourth line in the first sentence as indicated:

... "master handle" to "simultaneously" disconnect all "ungrounded" conductors ...

SUBSTANTIATION: Section 230-71(b) should be amended to conform to the requirements of Sections 230-74 and 600-2(a), Exception and other applicable provisions of this Code.

PANEL ACTION: Reject.

PANEL COMMENT: This is already required in Section 230-74.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1572

4- 92 - (230-71(b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first line of the sentence as indicated:

Two or (three) "more" single-pole switches or ...
SUBSTANTIATION: In the interest of safety, clarity and consistency, this change should be made because "two or three" single-pole switches or breakers is not wholly compatible with the term "multiwire circuits" as used in the subject sentence (see definition for Branch Circuit, Multiwire on page 70-6 of this Code) and; furthermore, the existing sentence, as written, does not include 4-pole switches or breakers that are commonly used with separately derived systems as indicated in Section 250-5(d).

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent to limit handle ties to 3 single-pole breakers.

Separately derived systems are not covered under Article 230.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 83

4- 93 - (230-71(b), Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 230-71(b), add:

"Exception: Where used, handle ties shall not be installed to permit independent switch handle operation."

SUBSTANTIATION: The use of separate single-pole switches or breakers as multipole disconnects without proper "handle ties" or "master handles" on multiwire circuits (as in Section 210-4 and 230-71(b)), for example, is at an epidemic level and:

1. The Code does not adequately address the subject to emphasize the potential dangers involved when proper safeguards are not used (Section 230-71(b) touches on the subject).

2. These "multipole" devices are, all too often, installed without "handle ties" or "master handles" and this: (a) makes it very difficult or impossible for the trouble-shooter or others to pin-point the missing "handle tie"; and (b) makes it difficult or utterly impossible to know which handles to turn off before attempting to work on the circuit.

The above conditions do pose a very serious safety hazard that could easily lead to a disabling or fatal shock for repair-persons or others.

3. The subject devices are very frequently installed where loose-fitting nails, wires or screws are used as substitutes for "handle ties" which allow independent operation of the poles of the switch/breaker; this is also a serious safety hazard that could lead to a crippling or deadly shock.

The ever-pressing need for "handle ties" is exemplified by the above.

Finally, the need for approval of this recommendation (Exception) is urgent.

PANEL ACTION: Reject.

PANEL COMMENT: The present wording does not permit independent operation. See Section 230-74.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1256

4- 94 - (230-71(b), FPN's-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After existing FPN, add 2 new FPN's as indicated:

"(FPN): If the handles of multiple individual circuit breakers for a circuit are improperly secured, undesirable/hazardous individual opening of the ungrounded conductors may occur."

"(FPN): The term ungrounded conductors as used in Section 230-71(b) also applies to ungrounded neutral conductors of ungrounded circuits/systems and other conductors where used as neutral conductors in ungrounded corner- center-tapped delta-connected transformer systems, for example."

SUBSTANTIATION: This FPN should be added because individual circuit breakers, where used, should be required to be installed in an approved manner to ensure that all ungrounded conductors are simultaneously opened and additionally this would provide a meaningful/effective reference for the enhancement of Code enforcement/compliance, especially for those cases that are frequently observed in the field where such circuit breaker handles are loosely secured with undersized nails, screws or solid copper wires so as to allow individual opening of the ungrounded conductors of the circuit in violation of the applicable provisions/intent of Section 230-71(b).

The second (new) note should be added because, for reasons not clearly understood, a similar safety provision for 2-wire circuits was deleted from the 1984 NEC in Proposal 4-123-240-20(b) (over a panel member's objection). Nevertheless, the opening of ungrounded neutral conductors and other conductors, where used as neutral conductors, in ungrounded circuits/systems in accordance with the provisions of Section 230-71(b) is required because the hazardous voltage conditions that are common to "grounded circuits/systems" as indicated in Section 250-1(f), (FPN) may be present in the neutral and/or other conductors where used as neutral conductors in ungrounded circuits/systems.

As a reference, Section 250-1(f), (FPN) reads, in part, as follows: "Systems and circuit conductors are grounded to limit voltages due to lightning, line surges, or unintentional contact with higher voltage lines, and to stabilize the voltage to ground . . ."

Since any of the "voltage sources" listed in the above reference may charge/energize an ungrounded system and all of the circuits (including the neutral and other conductors where used as neutrals) of the system to very high levels of voltage, the possible consequences for not providing a means for opening all ungrounded conductors as indicated/intended in Section 230-71(b) and as expressed in this New (FPN) should become more apparent.

NOTE 1: See supporting material in enclosure #1 from Division 11, page 11-54, Section 63 of the American Electricians Handbook, Ninth Edition, 1970.

NOTE 2: Applicable provisions of this proposal may/should also be considered for adoption elsewhere in this Code, if deemed necessary.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The proposed wording does not add additional clarification.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1257

4- 95 - (230-71(c)-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After 230-71(b), (FPN), add new Section as indicated:

"230-71(c) Grounded Conductors. No switch/overcurrent device shall be connected in series with any conductor that is intentionally grounded except where specifically required/permitted by this Code."

SUBSTANTIATION: For reasons of safety, this change should be made to ensure compliance with the applicable provisions of Section 230-90(b), 240-22, Exception No 1 and 380-2(b), Exception No 1 and 2 and also to allay the chance of misunderstanding/misapplication in regards to switch/overcurrent device requirements because of the differences between Section 230-90(b), 240-22, Exception No 1 and 2 and 380-2(b), Exception No 1 and 2 and the requirements specified in Section 430-36 and 514-5.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes this is unnecessarily repetitive. This is already covered in the present Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 611

4- 96 - (230-72(c); 230-72(c), Exception; 230-72(c), Exception No. 2-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Access to Occupant(s). Each occupant shall have access to the service disconnecting means for their occupancy."

Exception No. 1: In a multiple-occupancy building where electric service and electrical maintenance are provided by the building management, and where these are under continuous building management supervision, the service and feeder disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

Exception No. 2: Where the occupant(s) has access to the feeder(s) and branch circuit disconnecting means for their occupancy."

SUBSTANTIATION: The occupant of a single-occupancy building should also have access to the service disconnecting means. A single occupant does not necessarily own the building or have such access.

Proposed Exception No. 1 is similar to the exception in Section 240-24(b) which requires in effect that even a single occupant have access to all overcurrent devices. In the case of fused switches or circuit breakers which serve as service, feeder, or branch circuit overcurrent devices, it requires, in effect, access to the disconnecting means also.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter's concerns are already covered under the following Sections: 230-70(a), 230-72(c), 230-91(c), 230-92 and 240-24(a) and (b).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1794

4- 97 - (230-72(c), Exception No. 2-(New)): Reject

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: Add a new exception No. 2 as follows:

Exception No. 2: In a Multiple-occupancy building where the occupant has ready access to the feeder and/or branch-circuit overcurrent devices for his occupancy.

SUBSTANTIATION: Relief is needed where there is no "continuous building management supervision", and access to the service disconnecting means location is prohibited, e.g. basement storage areas for mercantile stores.

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent to allow an exception only under continuous building management supervision.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 84

4- 98 - (230-74, Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 230-74, add:

"Exception: Where used, handle ties shall not be installed to permit independent switch handle operation."

SUBSTANTIATION: The use of separate single-pole switches or breakers as multipole disconnects without proper "handle ties" on multi wire circuits (as in Sections 210-4 and 230-71(b)), for example, is at an epidemic level and:

1. The code does not adequately address the subject to emphasize the potential dangers involved when proper safeguards are not used (Section 230-71(b) touches on the subject).

2. These "multipole" devices are, all too often, installed without "handle ties" and this: (a) makes it very difficult or impossible for the trouble-shooter or others to pin-point the missing "handle tie"; and (b) makes it difficult or utterly impossible to know which handles to turn off before attempting to work on the circuit.

The above conditions do pose a very serious safety hazard that could easily lead to a disabling or fatal shock for repair-persons or others.

3. The subject devices are very frequently installed where loose-fitting nails, wires or screws are used as substitutes for "handle ties" which allow independent operation of the poles of the switch/breaker; this is also a serious safety hazard that could lead to a crippling or deadly shock.

The ever-pressing need for "handle ties" is exemplified by the above.

Finally, the need for approval of this recommendation (Exception) is urgent.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-93. The exception is not an exception.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 612

4- 99 - (230-75): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: In the first sentence change the last word "equipment" to "disconnecting means".

SUBSTANTIATION: Editorial. To correlate with Section 230-70(b). If listed, the service disconnecting means provides for such disconnection. The literal wording of this section permits the disconnecting means to be located at the service overcurrent device enclosure where it may be "immediately adjacent" per Section 230-91, to a service disconnecting means without overcurrent protection provision.

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent that the grounded conductor disconnecting means be permitted to be located in sections other than that section containing the disconnecting means such as the distribution section if it is accessible. See Panel Action on Proposal 4-101.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1126

4- 100 - (230-75): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in the first sentence and the first line in the second sentences as indicated:

... the grounded "(neutral)" conductor from ...
... which all grounded "(neutral)" conductors can be ...

SUBSTANTIATION: Same as Proposal 4-54.

PANEL ACTION: Reject.

PANEL COMMENT: The grounded conductor may not be a neutral.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2631

4- 101 - (230-75): Accept

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add a 2nd paragraph

In a multisection switchboard, disconnects for the grounded conductor shall be permitted to be in any section of the switchboard provided any such switchboard section is marked.

SUBSTANTIATION: The ANSI Standard for Dead Front Switchboards, UL 891 and the Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switch Gear, UL 1558 allow the neutral disconnect to be in a section other than the main section.

Electrically, a switchboard is the same whether it is constructed as a single section or as a multi-section switchboard. Locating the grounded conductor disconnect in sections other than to the main allows a worker to open the disconnect for test purposes without the worker being exposed to live bus bars on the line side of the main and without the need to break a utility seal. Marking the section of the switchboard that contains the grounded conductor disconnect would facilitate such testing and also the inspection of the switchboard after installation.

When there is more than one set of utility metering, such as, in a switchboard with individual meters for each customer, the metering equipment is frequently located in switchboard sections which do not contain a service disconnect.

This proposal will permit the electrical utility to continue to seal access covers to all bussing on the line side of their metering equipment and provide disconnecting means for the grounded conductor in switchboard sections not containing a service disconnect.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1125

4- 102 - (230-76): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in the first sentence as indicated:

... or other (suitable) "identified" operating ...

SUBSTANTIATION: The use of the term "suitable" can/does result in an infinite variety of different Code interpretations/actions being used/applied in ways that could cause ineffective, undesirable or disastrous results. It is, therefore, strongly recommended that, in the interest of Code-required levels of safety, compliance and uniformity, the term "identified" (which is defined in Article 100/FPN on page 10) be used because it more adequately defines the requirements needed to ensure the establishment/maintenance of Code-mandated/sanctioned standards that are essential in the safeguarding of persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal does not alter the intent of the Code since the term "identified" includes suitable for use.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 613

4- 103 - (230-79(c)(1)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert the word "net" between "initial" and "computed".

SUBSTANTIATION: The disconnecting means should be permitted to be rated for the load after demand factors are applied (net load) rather than the connected load. Service-entrance conductors may be so rated per Section 230-42(b)(2) and the proposal would correlate these sections.

PANEL ACTION: Reject.

PANEL COMMENT: The present Code already indicates that the "computed" rather than the "connected" load is to be used.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3393

4- 104 - (230-82, Exceptions No. X, Y and Z-(New)): Reject

SUBMITTER: Armond Webb, Pacific Gas & Electric Co.

RECOMMENDATION: Add 3 new exceptions

Exception No. (New): Transform(s) and its devices as required by Article 450 - Transformers and Vaults and as permitted by 230-201.

Exception No. (New): Devices as required by Article 710-Over 600 volts, general and permitted by 230-201

Exception No. (New): Devices as required by Article 215-Feeders and permitted by 230-201.

SUBSTANTIATION: To clearly permit certain necessary devices and equipment on the supply side of the low voltage service disconnect in a high voltage service

This proposal is also based on the present 1987 NEC wording in 230-201 which is interpreted to permit low voltage service equipment to be the only service equipment used in a high voltage service.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal exceptions are not appropriate for the low-voltage section as covered in Section 230-82.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2989

4- 105 - (230-82, Exception No. 2): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Delete this exception.

SUBSTANTIATION: This proposal is intended to correlate with a proposal by the submitter to create a new article on disconnects for multiple buildings.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-164.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 893

4- 106 - (230-82, Exception No. 3): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

Meters in low-voltage systems, provided . . . (remainder unchanged).

SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and to incorporate recognized industry standards and practices. See proposed definitions of low-, medium- and high-voltage circuits, equipment and systems (Article 100 proposals).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

COMMENT ON VOTE:

CARRICK: This section should remain as written because to change it as the Ad Hoc Committee on Voltages indicates would allow voltages up to 1000 volts.

Log # 234

4- 107 - (230-82, Exception No. 6): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the Exception as indicated:

Exception No. 6: "Solar photovoltaic systems or" interconnected electric power production sources. See Article"s" 690 "or 705 as applicable".

SUBSTANTIATION: This change is urgently needed to reconcile the relationship between the subject exception and Articles 690 and 705. For example, in Section 230-82, Exception No. 6, the reader is told to see Article 690 but this article is about solar photovoltaic systems and not "interconnected electric power production sources". With this change, the existing Section 690-64(a) and Section 705-12 references to Section 230-82, Exception No. 6 will be clear.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 685

4- 108 - (230-82, Exception No. 6): Accept in Principle

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Revise second sentence of Exception No. 6 to read: See Articles 690 "and 705".

SUBSTANTIATION: To correlate with the requirements of Section 705-12, which was new in the 1987 NEC. Systems covered by Article 705 have similar requirements to those of Article 690 and should have the same recognition in this Exception.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 4-107.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2618

4- 109 - (230-83): Accept

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Revised text:

230-83 Transfer Equipment. Transfer equipment, "including transfer switches," shall operate such that all ungrounded conductors of one source of supply are disconnected before any ungrounded conductors of the second source are connected.

Note: Added material in quotations.

SUBSTANTIATION: The addition of the terminology "transfer switch" helps avoid confusion and provides better harmonization with NFPA 99, NFPA 110, Underwriters Laboratories standard UL 1008, NEMA standard ICS 2-447, IEEE/ANSI standards 100-1984, 446-1987 and 602-1986. Another submitted proposal recommends that Article 100 include the definition for transfer switch. The term transfer switch is currently used in Article 517-44 (b) and Article 517-60 (a) (4).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1127

4- 110 - (230-83, Exception No. 2): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first and second lines as indicated:

. . . used and (suitable) automatic or manual control equipment "identified for the purpose" is provided.

SUBSTANTIATION: The use of the term "suitable" can/does result in an infinite variety of different Code interpretations/actions being used/applied in ways that could cause ineffective, undesirable or disastrous results. It is, therefore, strongly recommended that, in the interest of Code-required levels of safety, compliance and uniformity, the term "identified" (which is defined in Article 100/FPN on page 10) be used because it more adequately defines the requirements needed to ensure the establishment/maintenance of Code-mandated/sanctioned standards that are essential in the safeguarding of persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-100.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2740

4- 111 - (230-83, FPN-(New)): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: New text:

(FPN): It is the intent of this section to also require disconnecting means in attached buildings that are separated by firewalls. See the definition of "building" in Article 100.

SUBSTANTIATION: It is common to attach a new building onto an existing building via a firewall. This FPN will aid the authority having jurisdiction in clearcut enforcement of this necessary section.

Building disconnects save firemen's lives.

PANEL ACTION: Reject.

PANEL COMMENT: There are many buildings that are separated by fire walls to reduce the insurance risk and may not have any relationship to separate building services.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 112 - (230-84 and Exception No. 3-(New)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Revise as follows:

"(a) Disconnect Required for Each. Where more than one building or structure is on the same property and under single management, and is served with more than one branch circuitrated 120 volts nominal, or higher, each such building or structure shall be provided with means for disconnecting all ungrounded conductors.

The disconnecting means shall be installed either inside or outside the building or structure at a readily accessible location.

Exception No. 1: No change.

Exception No. 2: No change.

Exception No. 3: Where the opening of the circuits may result in potentially unsafe conditions for personnel or property and all the following conditions are met:

(1) Access to live parts is limited to qualified persons in accordance with Sections 110-17(a) and 110-31(a);

(2) A warning sign is permanently located on or immediately adjacent to each equipment, warning that the disconnecting means is remotely located, and specifying the location and identification of each disconnect.

(b) Suitable for Service Equipment. The disconnecting means specified in (a) above shall be listed for use as service equipment.

Exception: For garages and outbuildings switches suitable for use on branch circuits shall be permitted as the disconnected means."

SUBSTANTIATION: Even though this section is in Article 230 it plainly applies to power/lighting feeders and branch circuits and can be construed as including other types of system conductors such as fire warning and control. Installation of additional disconnecting means for these types of circuits or fire pumps could cause increased hazards. "Low-voltage" protective or control systems do not warrant additional disconnecting means.

Many installations of a single branch circuit do not warrant a disconnecting means at a separate building or structure. For example, a light fixture on a pole or building automatically controlled by a photocell.

If snap switches are suitable for residential outbuildings, they, or other suitable switches should be suitable for similar or identical installations on nonresidential premises which are more apt to have qualified personnel.

Since the conductors of this section concern feeder or branch circuit conductors presumed to have proper disconnecting means and overcurrent protection "upstream", the requirement for location per Section 230-70 is not warranted as it concerns "unfused" service conductors.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel has received proposals for deleting or moving Section 230-84 which may involve other articles (such as Section 250-24) outside the scope of Panel 4. These changes cannot be made until any recommendations are received and acted upon by Panel 4 and or other involved Panels. See F.I. on 1978 NEC on this issue. The Panel therefore requests the establishment of an Ad Hoc Subcommittee to be appointed by the Correlating Committee.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-17.

COMMENT ON VOTE:

KASSEBAUM: I agree with the panel action to reject for the reasons stated in the substantiation for Proposal 4-113. I disagree with the panel comment for the reasons stated in my explanation of vote on Proposal 4-17.

4- 113 - (230-84): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Delete Section 230-84 in its entirety.
SUBSTANTIATION: The provisions of Section 230-84 apply to feeders and branch circuits between buildings which are on the premises beyond the service disconnecting means for the premises wiring. These requirements would be more appropriately located in Article 225.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Carrick, Herbert, Kassebaum, Stricklin.

EXPLANATION OF VOTE:

CARRICK: See Comment on Proposal 4-17.

HERBERT: I agree with the submitter. Article 225 is the proper location for 230-84.

KASSEBAUM: Same as Proposal 4-17.

STRICKLIN: Same as Proposal 4-17.

4- 114 - (230-84): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Delete this section.

SUBSTANTIATION: This proposal is intended to correlate with a proposal by the submitter to create a new article on disconnects for multiple buildings.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Stricklin.

EXPLANATION OF VOTE:

KASSEBAUM: I disagree with the submitter's substantiation for deleting this section, but I agree that it should be deleted for the reasons stated in the substantiation for Proposal 4-113.

STRICKLIN: Same as Proposal 4-17.

4- 115 - (230-84(a) and 230-84(c)-(New)): Reject

SUBMITTER: George B. Wiggin, Lusby, MD

RECOMMENDATION: Delete last line of paragraph (a) and add new text as follows:

230-84(c) Location shall be in accordance with Section 230-70.

Exception No. 1: Where the conductors serving the other building are protected by over-current devices at their point of supply then the required disconnecting means may be installed at any convenient location.

SUBSTANTIATION: If the conductors supplying the other building have overcurrent protection then they are by definition "feeder conductors". Therefore, you are not dealing with unfused conductors as in the case of services and there is no need to restrict the location of the disconnecting means.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Stricklin.

EXPLANATION OF VOTE:

KASSEBAUM: I agree with the submitter's substantiation, but I disagree with his proposal for the reasons stated in the substantiation for Proposal 4-113.

STRICKLIN: Same as Proposal 4-17.

4- 116 - (230-84(a), Exception No. 3-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 230-84(a), Exception No. 2, Add:

"Exception No. 3: Where used, handle ties shall not be installed to permit independent switch handle operation."

SUBSTANTIATION: Same as Proposal 4-98.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-93.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1128

4- 117 - (230-84(b)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the first sentence as indicated:
... shall be (suitable) "identified" for use ...
SUBSTANTIATION: Same as Proposal 4-102.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-102.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2240

4- 118 - (230-84(h), Exception): Reject
SUBMITTER: Joseph Penachio, Revere, MA
RECOMMENDATION: After the words "residential property" add the words "a branch circuit device."
SUBSTANTIATION: Many times freezers are located in garages or outbuildings and it's just not practicable to install a snap switch on a freezer circuit.
PANEL ACTION: Reject.
PANEL COMMENT: The branch-circuit device is not defined.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2589

4- 119 - (230-84(b), Exception No. 2-(New) and FPN-(New)): Reject
SUBMITTER: Leo Nagel, Bismarck, ND
RECOMMENDATION: Add a second exception to read as follows:
The disconnecting means that is supplied with a feeder having an equipment grounding conductor need not be listed for use as service equipment.
(FPN) See section 250-24 for connection of the equipment grounding conductor.
SUBSTANTIATION: The present wording permits other buildings or structures to be served with or without an equipment grounding conductor. It makes no sense that the disconnecting means be required to be suitable for use as service equipment when it is supplied with a feeder that contains an equipment grounding conductor.
The new exception will clarify the confusion regarding the bonding of the equipment grounding conductor to the grounded conductor of the feeder.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-112.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NEGATIVE: Stricklin.
EXPLANATION OF VOTE:
STRICKLIN: Same as Proposal 4-17.
COMMENT ON VOTE:
KASSEBAUM: Same as explanation of vote on Proposal 4-112.

Log # 2741

4- 120 - (230-90, Exception No. 3; 230-90, Exception No. 3, FPN-(New)): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Revise to read:
"Not more than six circuit breakers nor sets of fuses shall be permitted to total not more than 150% of the allowable service conductor ampacity."
(FPN): See Section 230-42(a).
SUBSTANTIATION: The entire electrical industry does not apply the present exception as it is written. This proposal is an attempt to legitimize common engineering practice which even the 1987 NEC Handbook defends on page 153. Why pretend otherwise?

PANEL ACTION: Reject.
PANEL COMMENT: It is the Panel's intent to allow up to six disconnects provided the calculated load per Article 220 does not exceed the ampacity of the service conductors.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2742

4- 121 - (230-90, Exception No. 3): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Revise to read:
"Not more than six circuit breakers or sets of fuses shall be permitted as means of complying with Section 230-80."
SUBSTANTIATION: The entire electrical industry does not apply the present exception as it is written. This proposal is an attempt to legitimize what is installed everyday. Six 100 a. breakers do not protect a 400 ampere service conductor.
PANEL ACTION: Reject.
PANEL COMMENT: It is the Panel's intent to allow up to six disconnects provided the calculated load per Article 220 does not exceed the ampacity of the service conductors.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2208

4- 122 - (230-90(a), Exception No. 5-(New)): Reject
SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.
RECOMMENDATION: Add new Exception No. 5:
For dwelling units, conductors protected as permitted by Note 3, Notes to Tables 310-16 through 310-31.
SUBSTANTIATION: This note has been in the Code for many years, but I find from teaching that many electricians have no idea that it exists. All residential electricians know that 4/0 Aluminum is permitted for a 200 amp. dwelling service, but when it comes time to find it in the Code, there is no reference under "Service Equipment — Overcurrent Protection". With the addition of all the new ampacity tables it is even more difficult to find these notes than in the past.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel does not wish to proliferate the use of cross referencing.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 355

4- 123 - (230-90(a), FPN-(New)): Reject
SUBMITTER: Bob Middleton, Pocatello, ID
RECOMMENDATION: Add (FPN) see Note 3 310-16—310-31 for three-wire, single-phase dwelling services.
SUBSTANTIATION: I believe this section should reference this section as Note 3 relates to the seizing of service entrance conductors.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-122.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2527

4- 124 - (230-91(b)): Reject
SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association
RECOMMENDATION: Delete paragraph (b) in its entirety and renumber paragraph (c) as (b).
SUBSTANTIATION: The provisions of paragraph (b) apply to feeders and branch circuits between buildings which are on the premises beyond the service overcurrent protection. These requirements are more appropriately covered by Section 225-9.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Stricklin.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-17.

STRICKLIN: Same as Proposal 4-17.

Log # 2991

4- 125 - (230-91(b)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA.

RECOMMENDATION: Delete this subsection.

SUBSTANTIATION: This proposal is intended to correlate with a proposal by the submitter to create a new article on disconnects for multiple buildings.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Kassebaum, Stricklin.

EXPLANATION OF VOTE:

KASSEBAUM: I disagree with the submitter's substantiation for deleting this section, but I agree that it should be deleted for the reasons stated in the substantiation for Proposal 4-113.

STRICKLIN: Same as Proposal 4-17.

Log # 354

4- 126 - (230-92): Accept

SUBMITTER: Edward J. Huber, Huntington, NY

RECOMMENDATION: In fourth line, add the word "ampere" between "lower" and "rating" so that the portion after the last comma reads,
". . . , and shall be of lower "ampere" rating than the service overcurrent device."

SUBSTANTIATION: Above proposal would improve the clarity by indicating that "lower rating" applies only to the ampere rating and not to any other rating.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3392

4- 127 - (230-94, Exceptions No. X, Y and Z-(New)): Reject

SUBMITTER: Armond Webb, Pacific Gas & Electric Co.

RECOMMENDATION: Add 3 new exceptions

Exception No. (New): Transformer(s) and its devices as required by Article 450 - Transformers and Vaults and as permitted by 230-201.

Exception No. (New): Devices as required by Article 710-Over 600 volts, general and permitted by 230-201

Exception No. (New): Devices as required by Article 215 Feeders and permitted by 230-201.

SUBSTANTIATION: To clearly permit certain necessary devices and equipment on the supply side of the low voltage service over current devices in a high voltage service.

This proposal is also based on the present 1987 NEC wording in 230-201 which is interpreted to permit low voltage service equipment to be the only service equipment used in a high voltage service.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal exceptions are not appropriate for the low-voltage section covered by Section 230-94.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 894

4- 128 - (230-94, Exception No. 5): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

Meters in low-voltage systems, provided . . . (remainder unchanged).

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-106.

Log # 895

4- 129 - (230-95): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

230-95. Ground-Fault Protection of Equipment.

Ground-fault protection of equipment shall be provided for solidly grounded wye low-voltage services of more than 150 volts to ground, for each service disconnecting means rated 1000 amperes or more.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-106.

Log # 1463

4- 130 - (230-95): Reject

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Revise the first sentence of Section 230-95 as follows:

"Ground-fault protection of equipment shall be provided for solidly grounded wye electrical services and separately derived systems of more than 150 volts to ground, . . ."

SUBSTANTIATION: The need for ground-fault protection of equipment on high capacity systems has been adequately documented. An arcing ground fault cannot tell the difference between a high capacity service and a high capacity separately derived system.

PANEL ACTION: Reject.

PANEL COMMENT: Separately derived systems are covered by Articles 445, 450, 690 and others. No technical substantiation was provided.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Fischer, Herbert.

EXPLANATION OF VOTE:

FISCHER: In view of the acceptance by Code Panel 1 to include "the source of a separately derived" in premises wiring, this proposal is a companion proposal and should be accepted. This separately derived system should be treated no different than any other service for ground fault protection.

HERBERT: I agree with the submitter. The time has come to extend this protection to cover separately derived systems.

Log # 2302

4- 131 - (230-95): Reject

SUBMITTER: Verne A. Sechler, Columbus, OH

RECOMMENDATION: Delete the word "wye" from the second line of the opening paragraph.

SUBSTANTIATION: Ground fault protection for solidly grounded services of 1000 amperes or more should be required regardless of the connection configuration. Restricting this requirement to "wye" configuration can cause more hazard than it was intended to eliminate.

To override the ground fault protection equipment requirement for services of 480/277 volt 4 wire wye solidly grounded, services of 480 volt 3 wire ungrounded delta and 480 volt 3 wire corner grounded delta are being installed. These services may be safe for installations where the electrical system is

monitored by qualified people such as industrial plants but are questionable for commercial establishments. To override the present requirement, there have been instances where a 480/277 volt, 4 wire wye utility service was connected 3 wire delta in the customer's service equipment and the neutral not carried through. Adoption of the proposal would eliminate the hazards the restricted requirement has created.

PANEL ACTION: Reject.

PANEL COMMENT: The technical substantiation for this was based on 480/277-volt wye-connected services. This proposal does not provide substantiation for expanding the requirement to the other systems indicated.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3332

4- 132 - (230-95 and 230-95, Exception): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Change the words "services" and "service", respectively, to read "services or separately derived systems" and "service or separately derived system", respectively, wherever used in this section, and revise Exception No. 1 to read:

Exception No. 1: The provisions of this section shall not apply to a service or separately derived system disconnecting means where a nonorderly shutdown will introduce additional or increased hazards, such as in a continuous industrial process.

SUBSTANTIATION: Section 90-1(a) states that the purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. Grounded neutral separately derived systems of more than 150 volts to ground are just as susceptible to disastrous arcing ground faults as are services and are, from this viewpoint, indistinguishable from services. It is not logical to safeguard persons and property only from hazards arising from sustained arcing ground faults generated by services, and not to provide equivalent safeguards against identical hazards from separately derived systems, especially in view of the fact that the distinction between services and separately derived systems is principally one of definition only. Ground-fault protection, as required by the NEC, is not very popular, and the common lack of enthusiasm for its use routinely leads to tortured, far-fetched stretching of facts to turn a service into a separately derived system.

A blanket requirement for ground-fault protection when sustained arcing ground faults are otherwise possible would eliminate all argument and make for safer installations, while the proposed revised Exception No. 1 would allow exemption for hardship cases, industrial and otherwise. Hazards arising from nonorderly shutdown are by no means limited to continuous industrial processes.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-130.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Herbert.

EXPLANATION OF VOTE:

HERBERT: I believe that all high capacity circuits that are capable of developing arcing ground faults should be protected regardless of whether it is a service or separately derived.

Log # 897

4- 133 - (230-95, FPN): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise second FPN to read:

(FPN): It is recognized that ground-fault protection may be desirable for service disconnecting means rated less than 1000 amperes on solidly grounded wye low-voltage systems having more than 150 volts to ground.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Kassebaum.

EXPLANATION OF VOTE:

KASSEBAUM: Same as Proposal 4-4.

COMMENT ON VOTE:

CARRICK: Same as Proposal 4-106.

Log # 235

4- 134 - (230-95(a)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in the first sentence as indicated:

... service disconnecting means to "simultaneously" open all ...

SUBSTANTIATION: Where life-safety is involved, the requirement/intent should be more meaningfully defined. For example, see Section 230-74.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in Section 230-74.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NOT VOTING: Hunter.

EXPLANATION OF NOT VOTING:

HUNTER: I represent the Aluminum Association and have been instructed to abstain (not vote) on this proposal.

Log # 751

4- 135 - (230-95(a), Exceptions No. 1 and 2): Reject

SUBMITTER: Gerald T. Steele, Bear, DE

RECOMMENDATION: Proposing the deletion of Exception No. 1 and revising text for Exception No. 2 revise as follows:

The provisions of this section shall not apply to fire pumps and service disconnecting means for a continuous industrial process or commercial shutdown where additional or increased hazards are introduced.

SUBSTANTIATION: The Exceptions of ground fault protection should be applied to commercial applications; hospital life support systems for example. The phrase "nonorderly shutdown" is ambiguous and not defined. Exception No. 1 and 2 would be combined to form general Exception No. 1.

PANEL ACTION: Reject.

PANEL COMMENT: The present exceptions express the intent of the Panel. No documentation to support the expansion of the exceptions to commercial applications.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NOT VOTING: Hunter.

EXPLANATION OF NOT VOTING:

HUNTER: Same as Proposal 4-134.

Log # 1404

4- 136 - (230-95(a), Exception No. 3-(New)): Reject

SUBMITTER: Marvin J. Fischer, Brookdale Hospital

Medical Center

RECOMMENDATION: Add a new Exception No. 3:

Exception No. 3: The provisions of this section shall not apply to a service disconnecting means for a health care facility where a nonorderly or immediate shutdown will introduce a hazard to the life and safety of the patients.

SUBSTANTIATION: Many hospitals which have ground fault protection and interruption systems have been subjected to nuisance tripping even though the systems in "theory" have been properly coordinated. This happens for many reasons least of all equipment tolerance, system design and installation. This becomes a life threatening situation. Patients in rooms throughout the hospital may be on life support systems such as respirators or may need constant monitoring.

At present Exception No. 1 provides for an exemption of this section for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards. Certainly a new orderly shutdown

of power in a hospital will introduce additional or increased hazards to life at least equal if not greater than an industrial process.

PANEL ACTION: Reject.

PANEL COMMENT: The present exceptions express the intent of the Panel. No documentation to support the expansion of the exceptions to hospitals. The exception for hospitals is the prerogative of Panel 17.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

NEGATIVE: Gubany, Herbert.

NOT VOTING: Hunter.

EXPLANATION OF VOTE:

GUBANY: I am voting negative on panel action since I agree with the submitter's substantiation. Hazards to life are of utmost importance. 250-95 should not apply to hospital systems just as it does not apply to industry continuous processes.

HERBERT: I believe an exception for a health care facility is as justified as exception #1 for industrial processes.

EXPLANATION OF NOT VOTING:

HUNTER: Same as Proposal 4-134.

COMMENT ON VOTE:

KASSEBAUM: I agree with the submitter's substantiation but I feel that Panel 17 is more knowledgeable concerning health care facilities and should make the decision on this matter and refer it to Panel 4 for correlation.

Log # 1405

4- 137 - (230-95(a), Exception No. 3-(New)): Reject

SUBMITTER: Marvin J. Fischer, Brookdale Hospital Medical Center

RECOMMENDATION: Add a new Exception No. 3:

Exception No. 3: The provisions of this section shall not apply to a service disconnecting means for a health care facility where a non orderly or immediate shutdown will introduce a hazard to the life and safety of the patients and the facility has the means to determine at the service switch that a ground fault exists in the system.

SUBSTANTIATION: Many hospitals which have ground fault protection and interruptions systems have been subjected to nuisance tripping even though the systems in "theory" have been properly coordinated. This happens for many reasons least of all equipment tolerances, system design and installation. This becomes a life threatening situation. Patients in rooms throughout the hospital may be on life support systems such as respirators and may need constant monitoring. Ground fault indication would allow for an orderly set of alternatives to be put in place to maintain the patient's life and safety. After these arrangements have been made, an orderly shutdown can be made and an investigation for the location of the fault.

At present, Exception No. 1 provides for an exemption of this section for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards. Certainly a new orderly shutdown of power in a hospital will introduce additional or increased hazards to life at least equal if not greater than an industrial process.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-136.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

NEGATIVE: Gubany, Herbert.

NOT VOTING: Hunter.

EXPLANATION OF VOTE:

GUBANY: Same as Proposal 4-136.

HERBERT: Same as Proposal 4-136.

EXPLANATION OF NOT VOTING:

HUNTER: Same as Proposal 4-134.

COMMENT ON VOTE:

KASSEBAUM: Same as Proposal 4-136.

Log # 3374

4- 138 - (230-95(b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the existing Section as indicated:

(b) (Fuses.) "Switch and Fuse Combination." If a switch and fuse combination is used, the (fuses employed) "switch and fuse" shall be capable of interrupting (any current higher than the interrupting capacity of the switch during a time when the) "the maximum short-circuit current that may be available at their supply terminals but when a line-to-ground fault condition occurs," the ground-fault protective system (will not) "shall" cause the switch to open (period) "as indicated in Section 230-95(a)."

SUBSTANTIATION: The wording "... fuses employed shall be capable of interrupting ANY CURRENT higher than the interrupting capacity of the switch ..." is not true/clear because such fuses will function to open the circuit only when the current exceeds the fuse rating as indicated in Sections 110-9 and 240-1, (FPN):

The wording "... capable of interrupting any current higher than the interrupting capacity of the switch during a time when the ground-fault system will not cause the switch to open." is lacking in clarity and/or consistency because the ground-fault system only provides protection for low-level line-to-ground fault current while the required overcurrent/short-circuit current protection is provided only by the fuses and since the "switch and fuse" is a combination, the fault-current interrupting rating of the switch and fuse should not be less than that of the maximum fault-current available at the supply terminals in accordance with the applicable provisions/intent of Sections 110-9 and 230-65.

PANEL ACTION: Reject.

PANEL COMMENT: This is covered in Section 230-65.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 615

4- 139 - (230-95(b), FPN): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert: "continuous current" between "actual" and "overcurrent" in the first fine print note.

SUBSTANTIATION: Clarification. To indicate that continuous current rating rather than instantaneous trip rating is intended.

PANEL ACTION: Accept in Principle.

In the Code revise the first FPN as follows:

Add "continuous current" between "highest" and "trip".

PANEL COMMENT: The Panel believes that "continuous current" should be properly located between "highest" and "trip" in the present Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

FISCHER: The code panel voted affirmatively to number the FPN's in this section to conform to the style manual. Should this not be shown as a code panel proposal?

Log # 86

4- 140 - (230-95(c)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in the second second sentence as indicated:

... test shall be made and shall be available) "provided" to the authority having jurisdiction "as required".

SUBSTANTIATION: This subject sentence weak and indecisive; it would/could permit the Test Report to be left on the door handle at the site. The Test Report is an important document that may be used in future legal action; therefore, guidelines are needed to ensure that the report is received by the jurisdiction.

PANEL ACTION: Reject.

PANEL COMMENT: No documented evidence of a problem submitted to the Panel.

Does not add clarity.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3375

4- 141 - (230-95(c)-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 230-95(b), add new Section as indicated:

"(c) Short-Circuit Withstand Rating - Fuse and Switch. Fuse and switch combinations, where used, shall have a short-circuit current withstand rating that is not less than the maximum fault current available at the supply terminals as indicated in Section 110-10."

SUBSTANTIATION: Since the fuse and switch is a combination, a short-circuit current withstand rating that is not less than the maximum fault current available at the supply terminals is required in accordance with the applicable provisions/intent of Sections 110-10 and 230-65.

This is a most vital safety measure in view of the ever-increasing trend towards higher levels of fault current that is available in/at electrical service equipment.

PANEL ACTION: Reject.

PANEL COMMENT: Sections 110-16 and 230-65 currently require this.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 87

4- 142 - (230-95(d)-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 230-95(c), add:

"(d) Service equipment short-circuit withstand rating. The short-circuit withstand rating of service equipment shall not be less than the maximum fault current available at the line terminals of the equipment. The short-circuit withstand rating shall be plainly marked on the equipment."

SUBSTANTIATION: This is a most vital safety requirement in view of the ever-increasing trend toward higher fault currents available in/at electrical equipment. For example in electrical equipment may have fuses/circuit breaker rated to interrupt 100,000 A available at the terminals but unless the equipment has a short-circuit withstand rating equal to 100,000 A, the system may be a ticking time bomb.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in Sections 110-10, 230-65 and 230-70.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 896

4- 143 - (Article 230, Part H, Title): Reject
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise title to:

H. Medium- And High-Voltage Services.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

Log # 898

4- 144 - (230-200): Reject
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

230-200. General. Medium- and high-voltage service conductors and equipment, shall comply . . . (remainder unchanged).

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

Log # 899

4- 145 - (230-200, FPN): Reject

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

(FPN): For clearances of conductors of medium- and high-voltage services, see National Electrical Safety Code (ANSI C2-1984).

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

Log # 1383

4- 146 - (230-201): Reject

SUBMITTER: James H. Richards, Middle Department Inspection Agency, Inc.

RECOMMENDATION: Delete section 230-201 as written in the 1987 National Electrical Code Install section 230-201(a) as written in the 1984 Code (Verbatim)
1984 Section 230-201 CLASSIFICATION OF SERVICE CONDUCTORS.

(a) Secondary Conductors. The secondary conductors shall constitute the service conductors where the step-down transformers are located as follows:

(1) outdoors (2) in separate building from building or other structure served; (3) inside the building or other structure served where in a vault complying with part C of Article 450 (4) inside the building or other structure served where in a locked room or other locked enclosure and accessible to qualified persons only or; (5) inside the building or other structure where in metal-enclosed gear

SUBSTANTIATION: With the present wording of Section 230-201 and the definition of "SERVICE POINT" many inspectors are left at a confused issue as to when section 230-95 should be enforced. In other words if you have a 480/277 wye connected inside the building transformer which has a 1000 ampere or larger disconnect means on the secondary can GROUND FAULT PROTECTION EQUIPMENT BE REQUIRED. THE GREATER FAULT CURRENTS OF THIS SYSTEM DOES NOT KNOW OR CARE FROM WHERE IT COMES. ALSO WHEN THE SECONDARY BUS OF THE TRANSFORMER IS VERY CLOSE AS WITH INSIDE THE BUILDING FAULT CURRENTS CAN BE MUCH HIGHER SINCE THE IMPEDANCE IS LOWER ON SHORT CONDUCTOR CONNECTIONS. IF 230-95 IS A DESIRABLE SAFETY FACTOR A CLEAR RULING ON WHAT ARE SECONDARY SERVICE CONDUCTORS OF UNDER 600 VOLTS IS BADLY NEEDED AND THE PRESENT SECTION 230-201 DOES NOT GIVE A CLEAR UNDERSTANDING.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes this proposal could preclude the application of the NEC to certain portions of premises wiring.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Cock.

EXPLANATION OF VOTE:

COCK: (230-201) The panel should make clear that 600 volt or less conductors SERVING ANY BUILDING are service conductors and are covered by article 230, chapters A-G.

Log # 2452

4- 147 - (230-201): Reject

SUBMITTER: Verne A. Sechler, Electric Light & Power Group

RECOMMENDATION: Revise 230-201 as follows:

230-201. Classification of Service Conductors.

(a) Primary Conductors. In all cases, the supply conductors that extend from the load side of the service point to the over 600 volts, nominal, service equipment shall be classified as service conductors.

(b) Transformer Secondary Conductors. Where transformers are used to change the voltage to 600 volts or less on the load side of the service point, the supply conductors that extend from the street main or from transformers to the service equipment of the building or structure served, shall also be classified as service conductors and shall meet all the requirements of Article 230.

Exception for (a) & (b)

When the basic supply to a building or structure is a dedicated supply circuit that serves a single operating unit or system, it shall be permitted to be installed as permitted by applicable Code articles.

The equipment supplied by the dedicated circuit and its disconnecting means shall have a plaque or directory to indicate that it is separately served and the location of the circuits disconnect.

SUBSTANTIATION: The general Code intent of article 230 is for the first disconnect and overcurrent devices to be installed as service equipment.

The proposed wording would clearly require service equipment in all high voltage service conductors and also in subsequent low voltage conductors which supply individual buildings or separate structure.

Panel 4's action on the 1987 TCD comments 4-139 and 4-143 created confusion. The acceptance of 4-139's substantiation indicated the panel intends to permit the service equipment in the low voltage conductors. The ACCEPTANCE AND COMMENTS of 4-143 seem to require service equipment in the high voltage conductors although, its words are interpreted to permit the service equipment in either the high or low voltage. So while the wording in the 1987 and 1984 NEC are interpreted to permit service equipment in the low voltage conductors.

Sections 230-82 & 94 contradict this by not identifying a transformer and its associated devices as permitted ahead of a low voltage main disconnecting means or the overcurrent protection. These Code conflicts create confusion and inconsistent enforcement. If it is the panels decision to permit a high voltage service with the service equipment in the lower voltage conductors then 230-82 and 94 should be amended to permit the necessary device; and, also indicate that equipment and conductors ahead of the low voltage service should comply with applicable articles such as 450, 710, 110, 210 and 215. The proposed exception to (a) and (b) will permit individual dedicated branch or feeder circuits separate from a building's or structure's general use circuits, for loads such as large motors, arc furnace, etc.

PANEL ACTION: Reject.

PANEL COMMENT: Part (b) is contrary to the definition in Article 100 of Service, Service Conductors, Service Equipment and Feeders.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Cock.

EXPLANATION OF VOTE:

COCK: Same as Proposal 4-146.

Log # 2528

4- 148 - (230-201): Accept

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Delete the last part of the sentence beginning with the word "regardless", so the sentence would read:

"The conductors from the service-point to the service disconnecting means shall be considered service conductors."

SUBSTANTIATION: This text was put in for clarification but has caused some confusion. Deleting it will not change the meaning of intent of this Section.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Cock.

EXPLANATION OF VOTE:

COCK: Same as Proposal 4-146.

4- 149 - (230-201): Reject

SUBMITTER: Martin J. Behling, Wisconsin Utilities Association

RECOMMENDATION: Revise 230-201 as follows:

"230-201. Classification of Service Conductors.

(a) Service Point. In all cases the conductors connected to the load side of the service point shall be classified as service conductors and shall terminate in a service disconnecting means in accordance with Section 230-205.

(b) Transformers. Where a transformer steps down, the voltage from above 600 Volts to 600 Volts or less, the secondary conductors of the transformer shall also be classified as service conductors and shall supply service equipment meeting the requirements of Article 230.

Exception: The secondary conductors of transformers utilized only for control power associated with equipment operating in excess of 600 Volts shall not be classified as service conductors.

(FPN): Ground-fault protection of equipment may be required. See Section 230-95."

SUBSTANTIATION: Section 230-201 as revised in the 1987 NEC has led to many differing published interpretations of the intent of this section.

This section must be revised to eliminate the present confusion as to the intent of the Code. The proposal is basically the same proposal we submitted for the 1987 NEC, with the addition of the exception for control power transformers. (See 1986 TCR proposal 4-207 and TCD comment 4-133.)

The proposed wording with editorial modifications is presently in the final draft of the Wisconsin Electrical Code - Volume 2, awaiting State legislative approval. (See Attachment "A".)

All this proposal is attempting to do is to regain the intent of Section 230-100 of the 1971 NEC, which was lost in the revision of this section in the 1975 NEC. The 1971 NEC in 230-100 stated that service facilities above 600 Volts had to comply with 230 Part L as well as the applicable preceding section of Article 230. The second paragraph went on to say that under certain conditions, the secondary conductors of step-down transformers were to be considered the service conductors to the "BUILDING PROPER." The key words "building proper" clearly defines the intent, that while the over 600 Volt conductors provide the service to the premises, in accordance with Part L, under certain conditions the secondary conductors were the service conductors to the BUILDINGS on the premises.

We believe the proposal as written returns to the original intent that the over 600 Volt service facilities be covered by Part H and maintains the concern of the NEC prior to 1987, that low voltage utilization systems derived from such high voltage services also be considered services. The proposal provides for application of the NEC identical to that of the Code prior to 1975 in a more direct manner. (See Attachment "B".)

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-147.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

NEGATIVE: Cock, Davis, Fischer.

EXPLANATION OF VOTE:

COCK: Same as Proposal 4-146.

DAVIS: The needs for the protection afforded by Section 230-95 are without question. I think the panel did not intend to circumvent 230-95 when we changed Section 230-201 in the current Code.

FISCHER: The present Code wording has been used to eliminate the use of Equipment Ground Fault Protection in many large installations where primary power is utilized. The use of ground fault protection, as covered in Section 230-95, has proven itself many times over the last ten to fifteen years. The number of proposals submitted to have Section 230-95 cover separately derived systems and those to change Section 230-201 back to the 1984 Code wording are indicative of its acceptance. To abandon this concept to put primary disconnects under the jurisdiction of the electrical inspector is not the final answer.

Either the inclusion of separately derived systems under Section 230-95 (proposal 4-130, log 1463) or acceptance of this proposal is necessary to assure proper equipment ground fault protection for solidly grounded wye electrical service of more than 150 volts to ground and not exceeding 600 volts phase to phase. I am, therefore, voting against the panel action to reject this proposal.

Log # 3370

4- 150 - (230-201): Reject

SUBMITTER: William F. Robertson, Simons-Eastern Consultants, Inc.

RECOMMENDATION: Revise 230-201 as follows:

230-201. CLASSIFICATION OF SERVICE CONDUCTORS

Service conductors shall be classified as in (a) and (b) below:

(a) BUILDINGS SERVED FROM UTILITY OWNED DISTRIBUTION SYSTEMS: Service conductors to buildings fed from utility owned distribution systems shall be the conductors from the service point to the service disconnecting means, regardless of whether they are on the primary or secondary side of a step down transformer.

(b) SERVICE CONDUCTORS IN AN INDUSTRIAL COMPLEX: In an industrial complex where buildings are supplied from nonutility owned distribution systems, service conductors shall be as defined in (1) and (2) below:

(1) SECONDARY CONDUCTORS. The secondary conductors shall constitute the service conductors where the step down transformers are located as follows: outdoors; in a separate building from the building or other structure served; inside the building or other structure served where in a vault complying with Part C of Article 450; inside the building or other structure served where in a locked room or other locked enclosure and accessible to qualified persons only; or inside the building or other structure served where in metal-enclosed switchgear.

(2) PRIMARY CONDUCTORS. In all cases not specified in (1) above, the primary side conductors shall be considered the service conductors.

Exception: Either the primary or secondary conductors shall be permitted to constitute the service conductors for an industrial complex where both the primary and secondary side voltages are over 600 volts. SUBSTANTIATION: In many industrial plants, most of the buildings are not served directly from an utility. They are served from plant owned, medium voltage distribution systems. Because of a change in the definition of service conductors in the 1987 Code, these buildings no longer are required to have the following: service disconnects; any limit on the number of disconnects on each incoming line feeder; ground fault protection on 1000 ampere and larger disconnecting means for incoming line feeders from solidly grounded, 208Y/120 and 480Y/277 volt systems; or any of the other requirements placed upon services and service disconnects.

The requirements of Article 230 should apply to all buildings, and not to only buildings served directly from an utility. The changes proposed are plagiarized from the 1984 Code, in an effort to maintain a sense of continuity in the definition of service conductors.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-146.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Cock.

EXPLANATION OF VOTE:

COCK: Same as Proposal 4-146.

Log # 900

4- 151 - (230-202(c)): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

(c) Open Work. Open wire services shall be installed in accordance with the provisions of Article 710, Part D.

SUBSTANTIATION: Removes redundant text. The requirement is in Part H which applies to services exceeding 600 v, nominal.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1734

4- 152 - (230-203): Reject

SUBMITTER: Michael Alley, BHP-Utah International, Inc.

RECOMMENDATION: Revised to read:

Warning Signs. Signs with words "Danger High Voltage Keep Out" shall be posted in plain view where unauthorized persons might come in contact with live parts. The sign shall include the highest operating voltage over 250 volts ac or dc.

SUBSTANTIATION: With a change in this section, all sections dealing with warning labels, signs, and markings can be standardized. The following sections can then be referred to article 230-203 in fine print notes:

450-8(d) Voltage Warning

665-23 Warning Labels

710-43 Enclosures

710-45 Power Cable Connections to Mobile Machines

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not believe that displaying operating voltage will increase safety. It could decrease safety.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 686

4- 153 - (230-204(a)): Accept

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Revise the first sentence to read:

"Where oil switches or air, "oil, vacuum, or sulfur hexafluoride" circuit breakers constitute the service disconnecting means, . . ."

SUBSTANTIATION: The NEC does not recognize the technology that is most frequently used in today's high-voltage systems, i.e., vacuum and sulfur hexafluoride circuit breakers. If these devices are used, there is no NEC requirement that there be a separate isolating switch ahead of the breaker, yet for the equivalent air or oil circuit breaker, this isolating switch is required. Since safety is the primary requirement of the NEC, and since there is no functional difference between an air or oil breaker and a vacuum or sulfur hexafluoride breaker, the need for the proposed revision is clear. I am not aware of sulfur hexafluoride or vacuum switches that might be used in place of oil switches with fuses for service equipment, but if such equipment is thought to be applicable, then the first phrase involving oil switches should also be suitable revised.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 616

4- 154 - (230-204(b)): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "service-entrance" to "service".

SUBSTANTIATION: To include service conductors which may not be "service-entrance" conductors.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1688

4- 155 - (230-204(d)): Accept

SUBMITTER: S. Griffin, Griffin Electric Co.

RECOMMENDATION: In second sentence change words "need not be provided" to, "shall not be required".

SUBSTANTIATION: Editorial and Style

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: The National Electrical Code is to be used as a safe method of installing electrical wiring. The phrase "shall not be required" should not be a part of the NEC.

Log # 617

4- 156 - (230-205(a), Exception): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Insert "load-side conductors" in lieu of "service conductors" in the second sentence.
SUBSTANTIATION: Conductors on the load side of the service disconnecting means (and overcurrent protection) constitute a feeder or branch circuit, not service conductors, and it appears this section concerns the building served by these conductors.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel believes that this is an editorial change. The word "service" more accurately describes the conductors involved.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3333

4- 157 - (230-205(a), Exception): Reject
SUBMITTER: S. Zackerman, Cincinnati, OH
RECOMMENDATION: In the second sentence of the Exception, revise the words "service conductors" to read "Feeder conductors".
SUBSTANTIATION: From the definitions in Article 100, it is clear that for the condition of remote service equipment described in the subject Exception, the building served has no service conductors, but rather is supplied by a feeder. By definition, all conductors on the load side of service equipment are feeders or branch circuit conductors, without regard to location of the service equipment.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-156.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 618

4- 158 - (230-205(a), FPN): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add "230-84" to the referenced sections.
SUBSTANTIATION: A reference to Section 230-84 would indicate the requirements for a disconnecting means in each building served are not abrogated by this section.
PANEL ACTION: Accept.
PANEL COMMENT: Editorial.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3168

4- 159 - (230-207(b)-(New)): Reject
SUBMITTER: Robert Picott, Department of Building & Safety, City of Los Angeles, CA
RECOMMENDATION: Change the first paragraph of 230-207 to be 207(a) and add a new 230-207(b) to read as follows:
Ground fault protection of secondary equipment shall be as required by Section 230-95.
SUBSTANTIATION: There has been close to a dozen failures and associated fires and injuries in 480/277 volt service switchboards in buildings in the City of Los Angeles over the last ten years. A requirement for having equipment ground fault protection on all service equipment rated 480/277 volts at 1000 amperes or more would alleviate this problem. The service equipment is not able to discern between a utility company supply and a customer owned high voltage transformer.
PANEL ACTION: Reject.
PANEL COMMENT: This is inappropriate for Section 230-207. Section 230-95 only applies to 600 volts phase-to-phase or less.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 901

4- 160 - (230-208, FPN): Reject
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Revise to read:
(FPN): See Tables 310-69 through 310-84 for ampacity of medium- and high-voltage conductors.
SUBSTANTIATION: Same as Proposal 4-106.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-4.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11
NEGATIVE: Carrick, Kassebaum, Pollock.
EXPLANATION OF VOTE:
CARRICK: Same as Proposal 4-4.
KASSEBAUM: Same as Proposal 4-4.
POLLOCK: This Proposal should be adopted since Tables 310-69 through 310-84 cover ampacity of conductors rated over 2,000 volts. Therefore, the Proposal will correlate with the revisions of Article 100.

Log # 64

4- 161 - (230-208(d)(2)): Reject
SUBMITTER: Maxim Klavansky, Dept. of Environmental Protection NY City, NY
RECOMMENDATION: Delete text.
SUBSTANTIATION: This statement is wrong. The sum of the currents from two current transformers is equal to the current in the third phase.
PANEL ACTION: Reject.
PANEL COMMENT: This paragraph is applicable to 3-phase systems with no phase-to-neutral loads.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 902

4- 162 - (230-208(e)): Reject
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Revise last line to read:
... overcurrent devices installed in medium- and high-voltage services.
SUBSTANTIATION: Same as Proposal 4-106.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-4.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12
NEGATIVE: Carrick, Kassebaum.
EXPLANATION OF VOTE:
CARRICK: Same as Proposal 4-4.
KASSEBAUM: Same as Proposal 4-4.

Log # 2453

4- 163 - (230-209): Reject
SUBMITTER: Verne A. Sechler, Electric Light & Power Group
RECOMMENDATION: Revise the section to read:
230-209. Surge Arresters (Lightning Arresters). Surge Arresters where used shall be installed in accordance with requirements of Article 280.
SUBSTANTIATION: The primary objective of applying surge arresters on a premises wiring system is to provide protection for that wiring system. To require that the surge arresters always be placed on the supply side of the service equipment is to disregard the proper protection of transformers in services greater than 600 volts. In these cases, the greatest protection is provided by mounting the surge arresters on the transformer itself, which means that the surge arresters are installed on the load side of the service equipment (circuit breaker or switch and fuses) protecting the transformer.
Your attention is also called to the Panel Comment 5-149 (Log #1674) in the 1983 NEC TCD in which CMP 5 stated: "It is the Panel's intent that surge arresters be permitted to be installed on either side of the service."
PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's intent that, where required by the authority having jurisdiction, the surge arrester shall be installed on the supply side of the service equipment under the conditions specified. This does not preclude the use of surge arrestors elsewhere on the premises wiring system.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Cock.

EXPLANATION OF VOTE:

COCK: (230-209) Surge arrester installations should be designed for the proper application protection which may NOT always be on the supply side.

ARTICLE 235 — MULTIPLE BUILDINGS OR STRUCTURES

Log # 2992

4- 164 - (Article 235-(New)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: A new article should be considered, as follows:

ARTICLE 235 MULTIPLE BUILDINGS OR STRUCTURES

235-1. SCOPE. This article covers supply conductors for and disconnecting means at buildings and structures supplied from other buildings or structures on the same premises. This article does not cover service conductors or equipment.

A. GENERAL

235.2. NUMBER OF SOURCES OF SUPPLY. A building or other structure served shall be supplied by only one source of supply.

Where a source of supply permitted under any of the following exceptions is a service, that supply shall be subject to the provisions of Article 230.

Where more than one source of supply is permitted under any of the following exceptions, a permanent plaque or directory shall be installed at each disconnecting means denoting all other disconnecting means on or in that building or structure and the function of or area supplied by each.

Exception No. 1. Fire pumps.

Exception No. 2: For emergency, legally required standby, optional standby, or parallel power production systems where a separate source is required.

Exception No. 3. Multiple-Occupancy Buildings. By special permission, in multiple occupancy buildings where there is no available space for disconnecting means accessible to all the occupants.

Exception No. 4. Capacity Requirements. Two or more sources shall be permitted:

a. Where the capacity requirements are in excess of 3000 amperes at a supply voltage of 600 volts or less; or

b. By special permission.

Exception No. 5. Buildings of Large Area. By special permission, for a single building or other structure sufficiently large to make two or more sources necessary.

Exception No. 6. For different characteristics, such as for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules.

235-10. SUPPLY WIRING METHODS. Installation of conductors supplying the buildings or structures within the scope of this article shall be in accordance with the applicable requirements of Chapter 3 and Article 225.

225-11. SIZE AND RATING OF SUPPLY CONDUCTORS.

(a) GENERAL. Conductors supplying the buildings or structures within the scope of this article shall be of sufficient size to carry the loads as computed in Article 220.

(b) UNGROUNDED CONDUCTORS. Ungrounded conductors shall have an ampacity of not less than:

(1) 100 amperes for a 3-wire supply to a one-family dwelling with six or more 2-wire branch circuits.

(2) 100 amperes for a 3-wire supply to a one-family dwelling with an initial net computed load of 10 kVA or more.

(3) 30 amperes where not more than two branch circuits originate at the building or structure supplied.

(4) 15 amperes where a single branch circuit originates at the building or structure served, or where the building or structure is supplied by multiple branch circuits originating ahead of that building or structure.

(FPN): An example would be a detached garage fed with two branch circuits.

(5) 60 amperes for other loads

(c) GROUNDED CONDUCTORS.

(1) Where a grounding connection is made to a grounded circuit conductor at the building disconnecting means as permitted in Section 250-24(a), the grounded circuit conductor shall not be smaller than the minimum size as required by Section 250-23(b) and Article 220.

(2) Where a grounding connection is not made to a grounded circuit conductor, the grounded circuit conductor shall not be smaller than the minimum size as required by Article 220.

(d) GROUNDING CONDUCTORS. Grounding conductors shall not be smaller than the minimum size as required by Section 250-95.

B. DISCONNECTING MEANS

235-20. GENERAL. Means shall be provided to disconnect all conductors in a building or other structure from the ungrounded supply conductors.

(a) LOCATION. The building disconnecting means shall be installed either inside or outside of a building or other structure at a readily accessible location.

Exception No. 1: For large capacity multibuilding industrial installations under single management, where it is assured that the disconnecting can be accomplished by establishing and maintaining safe switching procedures, the disconnecting means shall be permitted to be located elsewhere on the premises.

Exception No. 2: Buildings or other structures qualifying under the provisions of Article 685.

(b) MARKING. The building disconnecting means shall be permanently marked to identify its function.

(c) SUITABLE FOR USE. Each building disconnecting means shall be suitable for the prevailing conditions, and it shall be suitable for use as service equipment.

Exception: For garages and outbuildings on residential property, a snap switch or a set of 3-way or 4-way snap switches suitable for use on branch circuits shall be permitted as the disconnecting means.

235-21. MAXIMUM NUMBER OF DISCONNECTS.

(a) GENERAL. The building disconnecting means for each supply permitted by Section 235-2 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard. There shall be no more than six disconnects per source of supply grouped in any one location. Two or more branch circuits or feeders or both which do not qualify under one of the exceptions to 235-2 shall be considered a single source of supply for the purposes of this section.

Exception: For the purpose of this section, disconnecting means used solely for the control circuit of the ground fault protection system, installed as part of listed equipment, shall not be considered a building disconnect.

(b) SINGLE-POLE UNITS. Two or three single-pole switches or breakers, capable of individual operation, shall be permitted on multiwire circuits, one pole for each ungrounded conductor, as one multipole disconnect provided they are equipped with "handle ties" or a "master handle" to disconnect all ungrounded conductors of the building with no more than six operations of the hand.

235-22. GROUPING OF DISCONNECTS.

(a) GENERAL. The two to six disconnects permitted in Section 235-21 shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six disconnecting means permitted in Section 235-21, when used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.

(b) **ADDITIONAL BUILDING DISCONNECTING MEANS.** The one or more additional building disconnecting means for fire pumps or for emergency, legally required standby, or optional standby services permitted by Section 235-3 shall be installed sufficiently remote from the one to six building disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

(FPN): See Section 700-12(d) and (e) for emergency system sources.

(c) **ACCESS TO OCCUPANTS.** In a multiple-occupancy building, each occupant shall have access to the occupant's building disconnecting means.

Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the building disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.

235-24. **SIMULTANEOUS OPENING OF POLES.** Each building disconnecting means shall simultaneously disconnect all ungrounded supply conductors from the building or structure wiring system.

235-25. **DISCONNECTION OF GROUNDED CONDUCTOR.** Where the building disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of the disconnecting means. A listed removable wire connector or a pressure connector on a terminal bar shall be permitted for this purpose.

235-26. **MANUALLY OR POWER OPERABLE.** The building disconnecting means for ungrounded supply conductors shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means, or (2) a power-operable switch or circuit breaker provided the switch or circuit breaker can be opened by hand in the event of a power failure.

235-27. **INDICATING.** The building disconnecting means shall plainly indicate whether it is in the open or closed position.

Exception: 3-And 4-way snap switches as permitted in 235-20(c) Exception.

235-28. **EXTERNALLY OPERABLE.** An enclosed building disconnecting means shall be externally operable without exposing the operator to contact with live parts.

Exception: A power-operated switch or circuit breaker shall not be required to be externally operable by hand to a closed position.

235-29. **RATING OF DISCONNECT.** The building disconnecting means shall have a rating of not less than the total load to be carried, determined in accordance with Article 220. In no case shall the rating be lower than specified in (a), (b), (c), or (d) below.

(a) **BRANCH CIRCUITS ONLY.** For installations to supply only limited loads of (1) a single branch circuit originating at the building or structure, or (2) multiple branch circuits originating ahead of the building or structure supplied, the building disconnecting means shall have a rating of not less than 15 amperes.

(b) **TWO-CIRCUIT INSTALLATIONS.** For installations where not more than two branch circuits originate at the building or structure supplied, the building disconnecting means shall have a rating of not less than 30 amperes.

(c) **ONE-FAMILY DWELLING.** For a one-family dwelling, the building disconnecting means shall have a rating of not less than 100 amperes, 3-wire under either of the following conditions: (1) where the initial computed load is 10 kVA or more, or (2) where the initial installation consists of six or more 2-wire branch circuits.

(d) **ALL OTHERS.** For all other installations the building disconnecting means shall have a rating of not less than 60 amperes.

235-32. **OUTLETS ON THE SUPPLY SIDE OF BUILDING DISCONNECT.** No outlet in or on a building or structure shall be supplied from the supply side of a building or structure disconnecting means.

235-33. **TRANSFER EQUIPMENT.** Transfer equipment shall comply with Section 230-83.

C. OVERCURRENT PROTECTION

235-40. **WHERE REQUIRED.** Each ungrounded supply conductor shall have overcurrent protection sized and located in accordance with Article 240.

235-45. **GROUND-FAULT PROTECTION OF EQUIPMENT.** Ground-fault protection of equipment shall be provided for solidly grounded wye electrical supplies of more than 150 volts to ground, but not exceeding 600 volts phase to phase for each building disconnecting means rated 1000 amperes or more. The setting, the fuses where used, and the performance testing shall be in accordance with Section 230-95.

D. **SUPPLIES EXCEEDING 600 VOLTS, NOMINAL.**
235-70. **GENERAL.** Supply conductors and equipment used on circuits exceeding 600 volts, nominal, shall comply with all applicable provisions of the preceding sections of this article, Article 710, and with the following sections, which supplement or modify the preceding sections.

235-71. **CLASSIFICATION OF SUPPLY CONDUCTORS.** Where supply conductors for a particular source of supply are operating at different voltages above and below 600 volts, and where the building wiring complies with Section 235-32 with reference to both, the feeder operating at the lower voltage shall be considered the supply conductors for the purposes of this article.

(FPN): An example would be a transformer vault containing a medium voltage feeder and disconnect, step-down transformers, and a low voltage feeder carrying the entire building load; the low voltage feeder carrying the entire building load; the low voltage feeder constitutes the supply conductors.

235-73. **WARNING SIGNS.** Signs with the words "Danger High Voltage Keep Out" shall be posted in plain view where unauthorized persons might come in contact with live parts.

235-74. **ISOLATING SWITCHES.** Where oil switches or air or oil circuit breakers constitute the building disconnecting means, an air-break isolating switch shall be installed on the supply side of the disconnecting means and all associated equipment.

Exception: Where such equipment is mounted on removable truck panels or metal enclosed switchgear units, which cannot be opened unless the circuit is disconnected, and which, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all live parts.

The switch shall comply with the requirements of Section 230-20(b), (c), and (d).

235-75. **DISCONNECTING MEANS.**

(a) **LOCATION.** The building or structure disconnecting means shall be located in accordance with Section 235-20 or Section 230-208(b).

Exception: The disconnecting means shall be permitted to be located in a separate building or structure on the same premises. In such case the building disconnecting means shall be capable of being electrically opened by a readily accessible control device located as near as practicable to where the supply conductors enter the building supplied. The control device shall be permanently marked to identify its function and shall provide visual indication of the Off or On status of the remote building disconnect.

(b) **TYPE.** The building disconnecting means shall simultaneously disconnect all ungrounded conductors and shall be capable of being closed on a fault equal to or greater than the maximum available short-circuit current in the circuit at its supply terminals.

Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault closing rating of the disconnecting means.

235-79. **SURGE ARRESTERS.** Surge arresters installed in accordance with the requirements of Article 280 shall be placed on each ungrounded conductor on the supply side of the building disconnecting means, where required by the authority having jurisdiction.

SUBSTANTIATION: This proposal is submitted to resolve a philosophical impasse that has plagued the Code in recent years, which the submitter believes results from Article 230 being called upon to address two different functions that are at times impossible to reconcile. On the one hand, the primary function of the article is to effect a safe transition from unprotected utility

systems to premises wiring. On the other hand, the article also attempts to ensure that all buildings and structures have a proper means of disconnection for the safety of emergency personnel and other important reasons.

When the primary application of the Code was smaller commercial and residential applications, these two functions usually intersected. The service disconnecting means and the building disconnecting means were almost always the same thing. Outbuildings were addressed to some degree in Section 230-84. Other sections were modified to apply to applications that were not service related. It is important to remember that just because a piece of equipment is "suitable for use as service equipment" does not in any way make the application subject to all the rules for services, and quite rightly so. It is time to leave Article 230 to the utility interface only, and to include disconnecting issues only where they take place at the same point. The Code would then be free to cover the separate building issue in specific detail, taking each section point by point and making any necessary adjustments. The basic point is this: Separate buildings are supplied by conductors that leave their point of supply as overcurrent protected feeders, but which arrive as services in the philosophical sense of requiring a disconnecting means.

This fundamental reality must be addressed at the most fundamental level. In the submitter's jurisdiction there are numerous campus style customer owned primary distribution systems. One in particular feeds literally hundreds of buildings and structures, from single family homes to high rise buildings to agricultural buildings to industrial style occupancies. The medium voltage feeders on these premises all have overcurrent protection and are fully under the jurisdiction of the NEC, not the NESC. It is absolutely absurd to ignore 230-95 in every single building, for example, some of which have 2500 ampere solidly grounded 480Y/277 volt service disconnects, oops, building disconnects installed without GFPE.

Although appearing to complicate the Code, this proposal will make the Code much easier to use. Everyone can usually agree on where the service point is, and where the transition is being made between a utility system under the NESC and premises wiring governed by the NEC. Everyone can usually agree on where the property lines are. Once these are pinned down, then all the applicable requirements would usually show up in one article. If there is a utility interface, use Article 230; if not, use the new article.

The submitter understands that he lacks the necessary expertise to completely draft such an article, and would have preferred to simply make a philosophical proposal, however, the rules for Committee projects insist on specific language. The proposal was drafted to track the provisions of Article 230 as seemed appropriate; in general the units digits in the section numbers were made consistent. Some specific comments now seem in order.

1. 235-1. The submitter understands that the numbering of articles and the content of a scope statement are in the hands of the Correlating Committee, and this is merely a suggestion.

2. 235-2. It is the intent that whenever Article 230 could apply, it shall apply. Correlating proposals have been made to delete non service provisions from that article.

3. 235-20(a). The wording about "nearest the point of entrance" has been deleted to reflect the fact that these conductors are protected.

4. 235-21(a). The rule of 6 is now explicitly stated, which was never the case in 230-84.

5. 235-71. This language will restore GFPE to the majority, but not all, of high capacity 480Y/277 service, oops, building disconnects on these systems. It is hoped that this somewhat novel approach will avoid some of the problems that resulted in 230-201 being redrafted in 1987, with the resulting controversies. In the long run, Article 215 should contain a GFPE provision, but that is a different panel.

6. 235-74. In general the requirements of Article 710 are sufficient for these installations, however, it

seemed advisable to incorporate the requirements of Section 230-204 which go beyond that article in the direction of safety.

The submitter apologizes for the amount of processing space that will be required to print this proposal, but he hopes that the public discussion it is likely to invite make it worthwhile.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112. It is the Panel's belief that the creation of a new article is not encouraged. The information can be adequately covered in existing Code requirements.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-17.

COMMENT ON VOTE:

KASSEBAUM: I agree with the panel action to reject for the reasons stated in the substantiation for proposal 4-113. I disagree with the first sentence of the panel's comment for the reasons stated in the my explanation of vote on proposal 4-17.

ARTICLE 240 — OVERCURRENT PROTECTION

Log # 903

4- 165 - (240-1): Reject

Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

240-1. Scope. Parts A through G of this article provide the general requirements for overcurrent protection and overcurrent protective devices in low-voltage systems. Part H covers overcurrent protection in medium- and high-voltage systems.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

Log # 2726

4- 166 - (240-1, FPN-(New)): Reject

Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to Article 240-1 Scope.

"(FPN): For further information, see "IEEE Recommended Practice for the Protection & Coordination of Industrial and Commercial Power Systems, ANSI/IEEE Std 242-1986".

SUBSTANTIATION: The electrical blueprints for industrial and commercial buildings commonly indicate equipment selected without any consideration for overcurrent protective devices selected to eliminate single-phase operation of equipment, mis-operation of protective relays due to saturation of current transformers, improper selection of circuit breaker trip devices and/or protective relays leading to wide-spread damage or outages rather than minimizing damage to the immediate affected circuit. This reference will assist in proper application to meet NEC.

PANEL ACTION: Reject.

PANEL COMMENT: This is a design issue and also is not within the scope of Panel 4.

VOTE ON PANEL ACTION: Unanimously Affirmative.

systems to premises wiring. On the other hand, the article also attempts to ensure that all buildings and structures have a proper means of disconnection for the safety of emergency personnel and other important reasons.

When the primary application of the Code was smaller commercial and residential applications, these two functions usually intersected. The service disconnecting means and the building disconnecting means were almost always the same thing. Outbuildings were addressed to some degree in Section 230-84. Other sections were modified to apply to applications that were not service related. It is important to remember that just because a piece of equipment is "suitable for use as service equipment" does not in any way make the application subject to all the rules for services, and quite rightly so. It is time to leave Article 230 to the utility interface only, and to include disconnecting issues only where they take place at the same point. The Code would then be free to cover the separate building issue in specific detail, taking each section point by point and making any necessary adjustments. The basic point is this: Separate buildings are supplied by conductors that leave their point of supply as overcurrent protected feeders, but which arrive as services in the philosophical sense of requiring a disconnecting means.

This fundamental reality must be addressed at the most fundamental level. In the submitter's jurisdiction there are numerous campus style customer owned primary distribution systems. One in particular feeds literally hundreds of buildings and structures, from single family homes to high rise buildings to agricultural buildings to industrial style occupancies. The medium voltage feeders on these premises all have overcurrent protection and are fully under the jurisdiction of the NEC, not the NESC. It is absolutely absurd to ignore 230-95 in every single building, for example, some of which have 2500 ampere solidly grounded 480Y/277 volt service disconnects, oops, building disconnects installed without GFPE.

Although appearing to complicate the Code, this proposal will make the Code much easier to use. Everyone can usually agree on where the service point is, and where the transition is being made between a utility system under the NESC and premises wiring governed by the NEC. Everyone can usually agree on where the property lines are. Once these are pinned down, then all the applicable requirements would usually show up in one article. If there is a utility interface, use Article 230; if not, use the new article.

The submitter understands that he lacks the necessary expertise to completely draft such an article, and would have preferred to simply make a philosophical proposal, however, the rules for Committee projects insist on specific language. The proposal was drafted to track the provisions of Article 230 as seemed appropriate; in general the units digits in the section numbers were made consistent. Some specific comments now seem in order.

1. 235-1. The submitter understands that the numbering of articles and the content of a scope statement are in the hands of the Correlating Committee, and this is merely a suggestion.

2. 235-2. It is the intent that whenever Article 230 could apply, it shall apply. Correlating proposals have been made to delete non service provisions from that article.

3. 235-20(a). The wording about "nearest the point of entrance" has been deleted to reflect the fact that these conductors are protected.

4. 235-21(a). The rule of 6 is now explicitly stated, which was never the case in 230-84.

5. 235-71. This language will restore GFPE to the majority, but not all, of high capacity 480Y/277 service, oops, building disconnects on these systems. It is hoped that this somewhat novel approach will avoid some of the problems that resulted in 230-201 being redrafted in 1987, with the resulting controversies. In the long run, Article 215 should contain a GFPE provision, but that is a different panel.

6. 235-74. In general the requirements of Article 710 are sufficient for these installations, however, it

seemed advisable to incorporate the requirements of Section 230-204 which go beyond that article in the direction of safety.

The submitter apologizes for the amount of processing space that will be required to print this proposal, but he hopes that the public discussion it is likely to invite make it worthwhile.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-112. It is the Panel's belief that the creation of a new article is not encouraged. The information can be adequately covered in existing Code requirements.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-17.

COMMENT ON VOTE:

KASSEBAUM: I agree with the panel action to reject for the reasons stated in the substantiation for proposal 4-113. I disagree with the first sentence of the panel's comment for the reasons stated in the my explanation of vote on proposal 4-17.

ARTICLE 240 — OVERCURRENT PROTECTION

Log # 903

4- 165 - (240-1): Reject

Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise to read:

240-1. Scope. Parts A through G of this article provide the general requirements for overcurrent protection and overcurrent protective devices in low-voltage systems. Part H covers overcurrent protection in medium- and high-voltage systems.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

Log # 2726

4- 166 - (240-1, FPN-(New)): Reject

Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to Article 240-1 Scope.

"(FPN): For further information, see "IEEE Recommended Practice for the Protection & Coordination of Industrial and Commercial Power Systems, ANSI/IEEE Std 242-1986".

SUBSTANTIATION: The electrical blueprints for industrial and commercial buildings commonly indicate equipment selected without any consideration for overcurrent protective devices selected to eliminate single-phase operation of equipment, mis-operation of protective relays due to saturation of current transformers, improper selection of circuit breaker trip devices and/or protective relays leading to wide-spread damage or outages rather than minimizing damage to the immediate affected circuit. This reference will assist in proper application to meet NEC.

PANEL ACTION: Reject.

PANEL COMMENT: This is a design issue and also is not within the scope of Panel 4.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 167 - (240-2): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 13-50. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change title of Article 710 to: "Medium- And High-Voltage Systems".

Relocate alphabetically.

SUBSTANTIATION: Correlates with proposed change in title of Article 710.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 12

NEGATIVE: Carrick, Kassebaum, Pollock.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

POLLOCK: Same as Proposal 4-4.

4- 168 - (240-2): Accept in Principle

SUBMITTER: David Houseman, Phoenix, AZ

RECOMMENDATION: Include transformers Article 450 in the list of other Articles.

SUBSTANTIATION: Transformers are part of 240 and the list of equipment to be protected and should be included in the list.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Already in the table.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 169 - (240-2): Reject

SUBMITTER: Barry Bauman, American Society of Agricultural Engineers

RECOMMENDATION: Add "Phase Converters" to the list after Places of Assembly to appear as follows:

Places of Assembly	518
Phase Converters	430
Services	230

SUBSTANTIATION: This change is required to include requirements on phase converter installations into Article 430.

The term phase converter is not presently covered in the Code, and therefore, it must be uniquely identified in this section.

See proposal for new Part N to Article 430.

PANEL ACTION: Reject.

PANEL COMMENT: It is inappropriate to list other than articles because only articles are listed in the section as per the title.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 170 - (240-3, Exception No. 1): Reject

SUBMITTER: Raymond W. Eckardt, Hot Springs Vil., Ark.

RECOMMENDATION: Delete the second paragraph under Exception No. 1.

SUBSTANTIATION: The second paragraph of Exception No. 1 can be interpreted to permit, for example, a 3800 ampere fuse to protect a conductor rated 3200 amperes. This paragraph also implies that a non-standard fuse or circuit breaker rated less than 800 amperes cannot be used.

See also my proposal for a fine print note following Section 240-6.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not support the change. Furthermore, the Panel does not agree with the substantiation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 171 - (240-3, Exception No. 1): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise the words "... only if this rating does not exceed 800 amperes and the conductor ..." to read, "... only if this rating does not exceed 800 amperes, or if the conductor ...", and replace the second paragraph with "where the rating exceeds 800 amperes, see Section 240-6."

SUBSTANTIATION: Proposed change to the first paragraph is editorial, to remove the linkage between multioutlet receptacle branch circuits and circuits not exceeding 800 amperes implied by the word "and". The meaning of the second paragraph cannot be divined from either the text or the 1987 NEC Handbook. See submitter's proposal for section 240-6, which is submitted to complement this proposal.

PANEL ACTION: Reject.

PANEL COMMENT: This is not editorial. It is the Panel's intent that both conditions apply. The Panel believes the second paragraph is needed to clarify that a lower-than-standard overcurrent device is permitted.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 172 - (240-3, Exception No. 2): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in the exception as indicated:

... Exceptions No. 2, 3, 5, 8, 9 and 10; (364-10) "364-11" and (364-11) "364-12;" ...

SUBSTANTIATION: Editorial to correct an apparent error.

PANEL ACTION: Accept.

PANEL COMMENT: Editorial.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 173 - (240-3, Exceptions No. 4, 5 and 8): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Re-arrange Exceptions as indicated:

Existing	Change to
Exception No. 4	Exception No. "1"
Exception No. 5	Exception No. "2"
Exception No. 8	Exception No. "3"

(Re-number remaining exceptions.)

SUBSTANTIATION: Editorial to conform to the 1984 NEC Style Manual, Part A, A-2c.

PANEL ACTION: Accept.

PANEL COMMENT: Editorial.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 174 - (240-3, Exception No. 5; 240-5-(New)): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: New text:

Protection of Transformer Secondary Conductors. Transformer secondary conductors shall be protected against overcurrent in accordance with their ampacities as specified in Section 310-15.

Exception: If otherwise specifically permitted elsewhere in this Code. (Delete last sentence of Section 240-3, Exception No. 5)

SUBSTANTIATION: I continually review sets of electrical plans that do not comply to the "tap rules" for transformer secondary conductors. There is widespread ignorance that these conductors generally must have over-current protection unless meeting a specific exception.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in Sections 240-3 and 240-21. There is no substantiation for deleting the last sentence of Section 240-3.

VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 175 - (240-3, Exception No. 8): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Conductor overload protection shall not be provided where the interruption of the circuit would cause a hazard, such as in a material handling magnet. Short circuit and ground fault protection shall be provided." **SUBSTANTIATION:** Present wording is not a positive statement to prohibit conductor overload protection. If overload protection creates a hazard omission should be mandatory, not discretionary.

PANEL ACTION: Reject.

PANEL COMMENT: The omission of overload protection should be discretionary because of some situations where the greater hazard comes from the unprotected wiring. The judgement must include evaluating all hazards involved. To mandate total removal of overload protection could result in a greater hazard being created.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3335

4- 176 - (240-3, Exception No. 8): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise Exception No. 8 to read as follows:

Exception No. 8: Power Loss Hazard. Conductor overload protection shall not be required where the interruption of the circuit would create a hazard, such as in a material handling magnet circuit, for a fire pump service or feeder where overload protection is not permitted, or in emergency shutdown circuits requiring power to trip. Short-circuit protection shall be provided.

SUBSTANTIATION: Fire pump services and feeders are deemed by submitter to be so important with respect to omission of overload protection as to merit mention in this Exception.

Numerous situations occur where emergency shutdown circuits would not work (typically, cases involving use of a circuit breaker shunt trip) if power was lost, and thus introduce a severe personnel hazard. Such circuits need only short-circuit protection; typically the circuit breaker being shunt-tripped would provide such short-circuit protection.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel feels it is unnecessary to add additional examples. The present list adequately covers the Panel's intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3447

4- 177 - (240-3, Exception 9-(New)): Accept in Principle

SUBMITTER: Barry Bauman, Madison, WI

RECOMMENDATION: Add a new Exception 9 as follows:

Exception 9: Phase Converter Supply Conductors. Phase converter supply conductors for motor loads and non-motor loads in accordance with Part N of Article 430.

SUBSTANTIATION: A new Exception 9 is required to include requirements of phase converters into Article 430, and to recognize the procedures for circuit installation in the approximately twenty percent of the cases where motors are not supplied by the phase converter.

See proposal for new Part N to Article 430.

PANEL ACTION: Accept in Principle.

Revise present Section 240-3, Exception No. 3 as follows:

Insert a new second sentence "Phase converter supply conductors for motor loads and non-motor loads in accordance with Part N of Article 430".

PANEL COMMENT: The Panel agrees with the substantiation and has placed the proposal wording into the present Exception No. 3 for correlation and clarity.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Panel cannot reference something that does not exist. There is no part N in Article 430.

Log # 1636

4- 178 - (240-4): Accept

SUBMITTER: Joseph Misrahi, Metropolitan Transit Authority of Harris County

RECOMMENDATION: Change title to "Protection of Flexible Cords and Fixture wires"

SUBSTANTIATION: To agree with title of Section 240-3

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 823

4- 179 - (240-4, Exception No. 3): Reject

SUBMITTER: David L. Carpenter, NAP Consumer Electronics Corp.

RECOMMENDATION: Delete Exception #3 relating to flexible cord used in extension cords and require a suitable over-current protection in the cord set.

SUBSTANTIATION: NAPCEC has conducted short circuit tests on UL listed #16 AWG extension cord sets and has found that the 20 ampere breaker does not open and that a fire hazard can be produced. As substantiation of this statement we offer the video tape of such a test being conducted.

PANEL ACTION: Reject.

PANEL COMMENT: No documentation that safety has been enhanced by individual protection on No. 16 AWG cord sets.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Gubany.

EXPLANATION OF VOTE:

GUBANY: I vote negative on panel action since I agree with the submitter and that the ad hoc committee for the 1984 Code recommended that #16 gauge extension cord as well as #18 extension cord be protected.

Log # 687

4- 180 - (240-6): Reject

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Delete the second paragraph of Section 240-6, thus returning this Section to the wording in the 1984 NEC.

SUBSTANTIATION: The Code Panel appears to have made low voltage power circuit breakers illegal to use except at their maximum ampere rating. These breakers typically have a solid-state trip unit that is adjustable over a wide range (for example, a G. E. Micro-VersaTrip unit has a 320-800 A range for an 800 A breaker). In using the definition of readily accessible, I am assuming that a breaker installed in a metal enclosure with a hinged access door is readily accessible, thus this type of breaker could only be used with an 800 A rating. If this is the panel's intent, it then will require that all such types of trip units be eliminated, to be replaced with a multiplicity of trip units having adjustable ratings with no larger range than the spread between any two values in the listing of standard ampere ratings in this section. No justification was given in the Panel's action when this paragraph was added to the 1987 NEC that indicated a safety problem is this area. I would agree with the retention of this section if the wording would be changed to read: "... the rating of an adjustable trip circuit breaker having an externally operable means of adjusting the long time trip setting ...". The meaning of externally operable is well defined in Article 100, and would not prohibit the use of solid-state adjustable trip units, which are typically installed behind a metal barrier, pan, door, or access plate, and therefore are not externally operable when the installation is complete. The words "long time trip setting" are necessary to clarify that this setting, not the short time, instantaneous or ground fault setting of the trip unit are used in determining the "rating" of a circuit. The concern in this area really is the possibility of overloading of conductors beyond their ampacity by adjusting the long time trip setting above the ampacity of the circuit conductors and this concern should be reflected in clear and unambiguous wording of the requirements.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment 4-186.

The Panel feels that we met the submitter's concerns as outlined in the substantiation.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1509

4- 181 - (240-6): Reject

SUBMITTER: Louis W. Gaussa, IEEE Switchgear Committee
RECOMMENDATION: Add the following to the text:

Drawout low voltage power circuit breakers located behind a secured door (not readily accessible) are except.

SUBSTANTIATION: Power circuit breakers have always had adjustable overcurrent trip devices. This has facilitated selecting the appropriate trip points as dictated by the variety of numbers and sizes of conductors which may be selected for use at relatively high currents. These devices are currently in use behind secured doors.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1639

4- 182 - (240-6): Reject

SUBMITTER: David Lee Swindler, Square D Company

RECOMMENDATION: Revise as follows:

For the purpose of this article, the rating of an adjustable trip circuit breaker having readily accessible external means for adjusting the trip setting shall be the maximum permissible rating or setting. "Adjustable trip circuit breakers located behind a door or an exposed circuit breaker equipped with a cover or other means to preclude accidental changes in setting shall be considered to have inaccessible means of adjustment and the rating shall be considered to the value of the setting."

Note: Added material in quotations.

SUBSTANTIATION: Large circuit breakers have always had adjustable overcurrent trip devices. This has facilitated appropriate overcurrent protection of conductors as a function the size and numbers of cables used for a given load. In higher capacities, multiple cables of various sizes are used producing an array of protection requirements as a function of the size and number of cables used. It is impractical to provide a fixed frame size and rating for each combination of cable size and numbers at the higher currents. Also larger breakers are often associated with industrial installations in which systems are often revised to meet changing manufacturing needs.

Industrial users are concerned that a strict interpretation of this Code would require them to always cable to the maximum frame size of breakers. This is uneconomical, restrictive and contrary to usual practice.

There are reports of varying interpretations which in some cases breakers behind doors are considered inaccessible and in other cases full compacity cables are required on the basis of the adjustability of the breaker.

Clarification is necessary in order to comply with the intent of this requirement and to avoid unnecessary expenditures of materials and resources.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 2241

4- 183 - (240-6): Reject

Secretary's Note: The Correlating Committee directs the Panel to act on the proposal on its merits in accordance with Section 60-5 of NEC Operating Procedures. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: In accordance with Section 240-3, Exception No. 1 (second paragraph) and with the demands of the new ampacity tables the time has come to include ratings of all listed fuses and inverse-time circuit breakers larger than 1000 amperes.

SUBSTANTIATION: For example, according to table 310-27, 6 raceways containing three 750 MCM copper conductors would be rated 1980 amperes. The rating would have to be rated downwards. The users of the Code should know what is available between 1600 and 2000 amperes.

PANEL ACTION: Reject.

PANEL COMMENT: Does not conform to NFPA Regulations Governing Committee Projects, Section 10-10(c).

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 2377

4- 184 - (240-6): Reject

SUBMITTER: Robert L. Simpson, The Institute of Electrical and Electronics Engineers, Inc.

RECOMMENDATION: Delete the second paragraph of Section 240-6, thus returning this Section to the wording in the 1984 NEC.

SUBSTANTIATION: Circuit breakers have frequently had adjustable overcurrent trip devices. This has facilitated selecting the appropriate trip points as dictated by the variety of numbers and sizes of conductors which may be selected for use at relatively high currents.

No justification was given in the Panel's action when this paragraph was added to the 1987 NEC that indicated a safety problem in this area.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log #.2529

4- 185 - (240-6): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Delete the last paragraph in its entirety.

SUBSTANTIATION: Although this paragraph was put in the Code to clarify ratings, it has let to more confusion than might have existed before it was accepted. Adjustable trip elements on circuit breakers are necessary for coordination of short-circuit protection. They are intended to be selected and set by knowledgeable persons based on the conditions of the system and its protection requirements, just as fuses are intended to be selected and sized under the same conditions. The substantiation for the proposal to include this paragraph as it was submitted for the 1987 Code did not contain any documentation of misapplication to support the need for this paragraph.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

4- 186 - (240-6 and 240-6, Exception No. 2-(New)):

Accept

SUBMITTER: CMP 4

RECOMMENDATION: Revise Section 240-6 second paragraph as follows:

"For the purpose of this article, the rating of an adjustable trip circuit breaker having external means for adjusting the long-time pickup (ampere rating or overload) setting shall be the maximum setting possible."

Add Section 240-6, Exception No. 2 as follows:

Exception No. 2: Circuit breakers that have removable and sealable covers over the adjusting means, or are located behind bolted equipment enclosure doors, or are located behind locked doors accessible only to qualified personnel, shall be permitted to have ampere ratings equal to the adjusted (set) long-time pickup settings.

SUBSTANTIATION: It is the Panel's intent to permit the use of adjustable trip circuit breakers provided access for adjustment is limited. The term "trip setting" was redefined in terms that normally appear on the trip unit.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Gubany, Stricklin.

EXPLANATION OF VOTE:

GUBANY: I'm voting negative on panel action since I feel it is a fire hazard to be able to adjust an overcurrent device to settings higher than the conductor(s) rating.

STRICKLIN: Circuit breakers should have a cover to keep the means for adjusting the trip setting from being readily accessible. This cover should be made so that it has to be replaced after the trip setting has been adjusted. This trip setting once set should never have to be adjusted again unless the conductor size changes. If the adjustable setting has to be changed very often, then it could be leading to a problem in the electrical system, a problem that could cause a safety hazard.

Log # 3104

4- 187 - (240-6 and Exception-(New)): Reject

SUBMITTER: William F. Robertson, Simons-Eastern Consultants, Inc.

RECOMMENDATION: Revise the last paragraph Article 240-6 as follows:

For the purposes of this article, the rating of an adjustable trip circuit breaker having readily accessible external means for adjusting the trip setting shall be the maximum permissible rating or setting. Adjustable trip settings shall not exceed the maximum continuous current rating of a circuit breaker.

EXCEPTION:

In industrial installations where conditions of maintenance and supervision assure that only qualified persons will monitor and service the installation, the ratings of adjustable trip circuit breakers may be less than the maximum permissible rating or setting.

SUBSTANTIATION: The changes proposed address two concerns:

1. Applying adjustable trip circuit breakers beyond their continuous current ratings
2. Requiring installations with qualified design and maintenance personnel to comply with a provision appropriate for unqualified or unsupervised personnel.

The overcurrent trip unit on some adjustable trip circuit breakers are designed to function with a family of current sensors (ie, current transformers). Some combinations of current sensors and trip units permit

trip settings greater than the continuous current rating of a circuit breaker. The addition of the last sentence to the last paragraph in Article 240-6 is intended to clarify that the rating of adjustable trip circuit breakers should not be greater than the maximum continuous current rating of the breaker.

Many industrial installations have qualified design, operating and maintenance personnel to supervise operations and electrical load growth. The provisions of the last paragraph in Article 240-6 pose an unnecessary burden upon these installations.

In industrial installations, adjustable trip circuit breakers are often used to protect major feeders and equipment. Sometimes the maximum trip setting is 25 percent higher than the load served. For example, a 1600 A circuit breaker with 800 A current sensors is used to feed a motor control center with an 800 amperes bus. (The 1600 A circuit breaker is required because of the available fault current.) An 800 A feeder is desired. However, since the maximum trip setting on the breaker is 1000 A, a 1000 A feeder must be installed. There is no justification for the expense of the additional feeder capacity, where qualified design and maintenance personnel control operations and electrical load growth.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 3297

4- 188 - (240-6 and Exception-(New)): Reject

SUBMITTER: Anthony Tomeo, Westinghouse Electric Corporation

RECOMMENDATION: a) Change the last paragraph to read as follows:

For the purpose of this article, the rating of an adjustable trip circuit breaker with external means for adjusting the trip setting shall be the maximum setting possible.

b) Add:

Exception: Circuit breakers that have removable and sealable covers over the adjusting means AND are behind enclosure doors shall have a rating equal to the installed settings.

SUBSTANTIATION: The present wording which uses "readily accessible" and "maximum permissible rating or setting" is ambiguous. Specifically:

a) What is readily accessible?

The definition in "Article 100 - Definition" is written for equipment areas and not for equipment mounted in its own enclosure. I believe removable and sealable covers over the adjusting means AND enclosure doors in front of the breakers makes the adjustment not readily accessible. Some one else could disagree. Let's not leave this open to interpretation.

b) What is permissible?

The dictionary defines it as "allowable". Allowable (permissible) by whom - the breaker manufacturer, the user or by the device itself?

A "permissible rating" is set by the manufacturer (in line with ANSI standards) and this rated continuous current is shown on the nameplate as required by ANSI C37.13.

A "permissible setting" is determined and set by the user limited only by the device's setting adjustment range. Again, let us not leave this up to interpretation.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 3336

4- 189 - (240-6; 240-6, Exception No. 2-(New)); 240-6,
FPN-(New)): Reject
SUBMITTER: S. Zackerman, Cincinnati, OH
RECOMMENDATION: Make the following changes:
(1) Re-number the present Exception as Exception No. 1.

(2) Add a new Exception, as follows:

Exception No. 2: Above 800 amperes, listed and labeled fuses, or circuit breakers without overload trip adjustment above their rating, and having ratings other than the standard ratings enumerated, will be permitted. Conductor ampacity shall be not less than the rating of the overcurrent device exceeding 800 amperes, whether standard or nonstandard rating.

(3) Replace the second paragraph with the following:
For purposes of this article, the maximum possible overload setting (which need not necessarily correspond to any of the standard ratings enumerated) of an adjustable trip circuit breaker having externally accessible ready means for adjusting the overload setting shall be considered to be the circuit breaker rating.

(4) Add FPN, as follows:

(FPN): Circuit breakers requiring use of plugs, changing of sensors or sensor taps, or intentionally adjustable only from behind lockable door or removable panel, would not ordinarily be considered as having externally accessible ready means for adjustment..
SUBSTANTIATION: This proposal assumes that it remains the intent of the NEC that above 800 amperes conductors may not be protected in excess of their ampacity, even if nonstandard but otherwise listed and labeled overcurrent protective devices are used, and attempts to clarify ambiguities existing in Sections 240-3 and 240-6 in this regard.

The rule in the second paragraph of Section 240-6 is not clearly stated, and the criteria for application involves a use of the term "readily accessible" inconsistent with Article 100. The FPN is proposed to reduce the amount of inevitable haggling over what "external" means.

It is assumed that it is the intent of the second paragraph of 240-6 that the maximum possible setting of an easily adjustable circuit breaker establishes the minimum required ampacity of the protected conductor.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1448

4- 190 - (240-6, Exception No. 2-(New)): Reject

SUBMITTER: William F. Hoenigmann, Du Pont

RECOMMENDATION: Add:

Exception: Low voltage power circuit breakers are excluded from this requirement provided the overcurrent device is properly set and secure behind a closed door of the switchboard structure.

SUBSTANTIATION: Low voltage power circuit breakers are designed to be withdrawn from the switchboard. It is permissible to interchange circuit breakers of similar frame ratings which would necessitate the resetting of the overload device in order to protect load cables. It appears the original proposal was directed toward fixed mounted circuit breakers with the overcurrent adjustment controls not secured from possible tampering.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1817

4- 191 - (240-6, Exception No. 2-(New)): Reject

SUBMITTER: S. Telander, Raleigh, NC

RECOMMENDATION: Add the following exception at end of paragraph:

"Exception: Metal-enclosed low-voltage power circuit-breaker switchgear in accordance with ANSI/IEEE C37.20.1"

SUBSTANTIATION: Metal-enclosed low voltage power circuit-breaker switchgear is applied in specific applications where the conductor sizes are specified on installation drawings and the circuit-breaker trip device settings are established for proper protection of the conductors and loads. The circuit breakers are drawout and interchangeable to provide maximum continuity of service during maintenance, etc. For example, one drawout breaker can be applied to properly protect loads from 50-100% of its frame size rating by proper adjustment of the trip device settings.

In addition, the trip devices are located behind enclosure doors to protect against unauthorized adjustment of the trip device settings. Therefore the substantiation for the addition of the last paragraph to 240-6 in the 1987 NEC is not applicable or proper for this type of equipment.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1641

4- 192 - (240-6, Exception): Reject

SUBMITTER: David Lee Swindler, Square D Company

RECOMMENDATION: Add to Existing Exception

EXCEPTION: If the means of adjustment for adjustable trip circuit breakers are covered, enclosed behind a door, or are otherwise protected against accidental changes in setting, then the rating for the purpose of this article shall be considered to be the setting of the adjustment.

SUBSTANTIATION: Large circuit breakers have always had adjustable overcurrent trip devices. This has facilitated appropriate overcurrent protection of conductors as a function the size and numbers of cables used for a given load. In higher capacities, multiple cables of various sizes are used producing an array of protection requirements as a function of the size and number of cables used. It is impractical to provide a fixed frame size and rating for each combination of cable size and numbers at the higher currents. Also larger breakers are often associated with industrial installations in which systems are often revised to meet changing manufacturing needs.

Industrial users are concerned that a strict interpretation of this Code would require them to always cable to the maximum frame size of breakers. This is uneconomical, restrictive and contrary to usual practice.

There are reports of varying interpretations which in some cases breakers behind doors are considered inaccessible and in other cases full compacity cables are required on the basis of the adjustability of the breaker.

Clarification is necessary in order to comply with the intent of this requirement and to avoid unnecessary expenditures of materials and resources.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1021

4- 193 - (240-6, FPN-(New)): Accept
SUBMITTER: Raymond W. Eckardt, Hot Springs Vil., Ark.
RECOMMENDATION: Add the following at the end of Section 240-6.

(FPN): It is not the intent to prohibit the use of non-standard ampere ratings for fuses and inverse time circuit breakers.

SUBSTANTIATION: A misunderstanding of the intent of establishing standard ampere ratings has resulted in unnecessary revisions to the NEC. See my proposal for the deletion of the second paragraph of Exception No. 1, Section 240-3.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 1640

4- 194 - (240-6, FPN-(New)): Reject

SUBMITTER: David Lee Swindler, Square D Company

RECOMMENDATION: Add Fine Print Note as follows:

NOTE: Many adjustable trip circuit breakers are located within equipment behind closed doors. Others are equipped with covers or other means which precludes accidental changes in setting. For the purpose of this article, such adjustments are considered not readily accessible nor external and the rating shall be considered to be the value of the setting of the adjustment.

SUBSTANTIATION: Large circuit breakers have always had adjustable overcurrent trip devices. This has facilitated appropriate overcurrent protection of conductors as a function the size and numbers of cables used for a given load. In higher capacities, multiple cables of various sizes are used producing an array of protection requirements as a function of the size and number of cables used. It is impractical to provide a fixed frame size and rating for each combination of cable size and numbers at the higher currents. Also larger breakers are often associated with industrial installations in which systems are often revised to meet changing manufacturing needs.

Industrial users are concerned that a strict interpretation of this Code would require them to always cable to the maximum frame size of breakers. This is uneconomical, restrictive and contrary to usual practice.

There are reports of varying interpretations which in some cases breakers behind doors are considered inaccessible and in other cases full compacity cables are required on the basis of the adjustability of the breaker.

Clarification is necessary in order to comply with the intent of this requirement and to avoid unnecessary expenditures of materials and resources.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 4-186.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Stricklin.

EXPLANATION OF VOTE:

STRICKLIN: Same as Proposal 4-186.

Log # 719

4- 195 - (240-9): Reject

SUBMITTER: K. L. Paape, Asheville, NC

RECOMMENDATION: Delete the words "Thermal Cutouts" from the first sentence of Section 240-9.

SUBSTANTIATION: Thermal cutouts are obsolete products that have not been manufactured for over 50 years. The latest reference in application literature is 1932, (H. D. Braley "Application of Thermal Cutouts to Motor Protection", POWER, January 12, 1932), where their initial cost was two to three times that of ordinary renewal-type cartridges of equivalent rating. Thermal

cutouts were superseded by resettable overload relays that required no renewable links, occupied less space, and opened all ungrounded lines to the motor by acting upon a manual or magnetic contactor.

The Code should not be cluttered with obsolete technology. A companion proposal to remove the definition of "Thermal Cutout" from Article 100 has been submitted.

PANEL ACTION: Reject.

PANEL COMMENT: There may be "thermal cutouts" other than the one pictured in the substantiation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2099

4- 196 - (240-12): Reject

SUBMITTER: Ron Fesl, Pinckney, MI

RECOMMENDATION: Revise Section 240-12 to read:

240-12. Electrical System Coordination. Where an orderly shutdown is required to minimize hazard(s) to personnel and equipment, the system shall have: (1) Coordinated overload and short circuit protection, or (2) Coordinated short-circuit protection and overload indication based on monitoring systems or devices.

No change to the FPN

SUBSTANTIATION: This change is needed because the current wording does not require coordinated short circuit protection, but PERMITS a combination of coordinated short circuit protection and overload indication. I believe that the intent of this section is for orderly shutdowns where required. This can be accomplished through either total overload and short circuit coordination or short circuit coordination with overload indication.

PANEL ACTION: Reject.

PANEL COMMENT: While desirable it may not always be possible to achieve coordination.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Herbert.

EXPLANATION OF VOTE:

HERBERT: I believe the Code should require coordinated short circuit protection under this section.

4- 197 - (240-13-(New)): Accept

SUBMITTER: CMP 4

RECOMMENDATION: Add:

240-13. Ground-Fault Protection of Equipment. Ground-fault protection of equipment shall be provided in accordance with the provisions of Section 230-95 for solidly grounded wye electrical system of more than 150 volts to ground, but not exceeding 600 volts phase-to-phase for each building or structure main disconnecting means rated 1000 amperes or more.

Exception No. 1: The provisions of this section shall not apply to a disconnecting means for a continuous industrial process where a nonorderly shutdown will introduce additional or increased hazards.

Exception No. 2: The provisions of this section shall not apply to fire pumps.

SUBSTANTIATION: With the revision of Section 230-201 the Panel did not intend that ground-fault protection be avoided. It is the intent of the Panel to require ground-fault protection for each building or structure disconnect regardless of whether it is classified as a service disconnect or a building disconnect.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Gubany, Kassebaum.

EXPLANATION OF VOTE:

GUBANY: I am voting negative on panel action since there was no substantiation submitted to justify the panel action. Also Article 240 is not the article for ground fault protection. CMP 4 deals with overcurrent protection, not ground fault protection. Article 230 is the proper one.

KASSEBAUM: No documentation or technical substantiation was provided at the panel meeting that supports the need for this requirement. Without such information appearing in the substantiation of the

panel proposal, it's not possible to have adequate public review in accordance with the NFPA Regulations Governing Committee Projects, and the NFPA Operating Procedures of the National Electrical Code Committee. The panel should not be exempt from providing the same kind of substantiation which it requires from the public.

The panel's comment supporting their rejection of Proposal 4-131 actually contradicts their action on this proposal. That comment stated, "the technical substantiation for this was based on 480/277 V wye-connected SERVICES. This proposal does not provide substantiation for expanding the requirement to other systems indicated."

The technical substantiation and documentation which supported the inclusion of ground-fault protection of equipment in the Code was based on circumstances surrounding "services", and did not include equipment and wiring beyond the service. Therefore, since the panel has confirmed by their comment on Proposal 4-131 that there is no technical substantiation or documentation to indicate that there is a problem requiring ground-fault protection of equipment beyond the service, this proposal should be rejected.

COMMENT ON VOTE:

COCK: [240-13-(new)] There should be an exception if the disconnect is protected by the Service Ground Fault Protection.

Log # 3304

4- 198 - (240-20): Reject

SUBMITTER: Robert E. Kaeser, LSI Lighting Systems Inc.

RECOMMENDATION: New text:

Each leg of a "Double Fused" ungrounded voltage supply to be simultaneously interrupted upon removal of fuse.

SUBSTANTIATION: Possibility of only one leg of a "Double Fused" ungrounded supply circuit (208, 240, 480V) to blow, leaving the other leg energized, representing a possible hazard to service personnel who may not recognize need to remove both fuses.

PANEL ACTION: Reject.

PANEL COMMENT: Insufficient documentation. The Panel is unclear as to the submitter's concerns.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 236

4- 199 - (240-20(b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first line in the sentence as indicated:

... breakers shall "simultaneously" open all ...

SUBSTANTIATION: Where life-safety is involved, the requirement/intent should be more meaningfully defined. For example, see Section 230-74.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation was provided for the revised wording.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1258

4- 200 - (240-20(b) and Exception): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first line of the sentence in Section 240-20(b) as indicated:

... breakers shall "simultaneously" open all ...

After Section 240-20(b), amend the existing Exception as indicated:

Exception: Individual single-pole circuit breakers "installed to simultaneously open all ungrounded conductors of the circuit" shall be acceptable as the protection for each ungrounded conductor (of 3-wire direct-current or single-phase circuits, or for each ungrounded conductor of lighting or appliance branch circuits connected to 4-wire, 3-phase systems or 5-wire, 2-phase systems,) provided (such lighting or appliance circuits are supplied from a system having a grounded neutral and) no conductor in such "lighting or appliance" circuits operates at a voltage greater than permitted in Section 210-6.

SUBSTANTIATION: Section 240-20(b) should be changed because the need for simultaneous opening of all ungrounded conductors is a vital life/safety measure which is expressed in the meaning/intent of Sections 230-74 and 600-2(a), Exception and other applicable provisions of this Code.

The existing Exception should be revised because circuit breakers, where used, should be required to be installed in an approved manner to ensure that all ungrounded conductors are simultaneously opened (this would also provide a meaningful/effective reference for the enhancement of Code enforcement/compliance) especially for those cases that are frequently observed in the field where such circuit breaker handles are loosely secured with undersized nails, screws or solid copper wires so as to allow individual opening of the ungrounded conductors of the circuit in violation of the applicable provisions/intent of Section 240-20(b) and; furthermore, the existing Exception wording "for each ungrounded conductor of 3-wire direct-current or single-phase circuits, or for each ungrounded conductor of lighting or appliance branch circuits connected to 4-wire, 3-phase systems or 5-wire, 2-phase systems, provided such lighting or appliance circuits are supplied from a system having a grounded neutral" is unnecessary and redundant in view of the fact that the requirement/intent of the above wording is more adequately addressed in Section 210-6 which contains viable/effective guide lines to ensure compliance with the required voltage limitations for the subject circuits and Article 250 which contains the grounding requirements for such circuits.

PANEL ACTION: Reject.

PANEL COMMENT: No justification for this requirement on the identified systems. Common trip circuit breakers are available when and where used.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 90

4- 201 - (240-20(b), Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 240-20(b), Add:

"Exception: Where used, handle ties shall not be installed to permit independent switch handle operation."

SUBSTANTIATION: Same as Proposal 4-98.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter implies in his substantiation that a multiwire circuit is required to be supplied by a multipole device. No such requirement exists in the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1259

4- 202 - (240-20(b), FPN's-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 240-20(b), add 2 new FPN's as indicated:

"(FPN): The term ungrounded conductors as used in Section 240-20(b) also applies to ungrounded neutral conductors of ungrounded circuits/systems and other conductors where used as neutral conductors in ungrounded corner-center-tapped delta-connected transformer system, for example."

Add second new FPN as indicated:

"(FPN): If the handles of multiple individual circuit breakers circuits are improperly secured, undesirable/hazardous individual opening of the ungrounded conductors may occur."

SUBSTANTIATION: This note should be added because, for reasons not clearly understood, a similar safety provision for 2-wire circuits was deleted from the 1984 NEC in Proposal 4-123-240-20(b) (over a panel member's objection).

The opening of ungrounded neutral conductors in ungrounded circuits/systems in accordance with provisions of Section 240-20(b) is required because the hazardous voltage conditions that are common to "grounded circuits/systems" as indicated in Section 250-1(f), (FPN) may be present in the neutral and/or other conductors where used as neutral conductors in "ungrounded circuits/systems."

As a reference, Section 250-1(f), (FPN) reads, in part, as follows: "Systems and circuit conductors are grounded to limit voltages due to lightning, line surges, or unintentional contact with higher voltage lines, and to stabilize the voltage to ground . . ."

Since any of the "voltage sources" listed in the above reference may charge/energize an ungrounded system and all of the circuits (including the neutral and other conductors where used as neutrals) of the system to very high levels of voltage, the possible consequences for not providing a means for opening all ungrounded conductors as indicated/intended in Section 240-20(b) and as expressed in this New (FPN) should become more apparent.

NOTE 1: See supporting material in enclosure #1 from Division 11, page 11-54, Section 63 of the American Electricians' Handbook, Ninth Edition, 1970.

NOTE 2: Applicable provisions of this proposal may/should also be considered for adoption elsewhere in this Code, if deemed necessary.

Note: Supporting Material Available for Review at NFPA Headquarters.

The second FPN (new) should be added because circuit breakers, where used, should be required to be installed in an approved manner to ensure that all ungrounded conductors are simultaneously opened (this would also provide a meaningful/effective reference for the enhancement of Code enforcement/compliance) especially for those cases that are frequently observed in the field where such circuit breaker handles are loosely secured with undersized nails, screws or solid copper wires so as to allow individual opening of the ungrounded conductors of the circuit in violation of the applicable provisions/intent of Section 240-20(b).

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not understand the intent of the first FPN. There is no documentation of a problem in regards to the second FPN. The submitter is referring to out-of-date references and systems indicated are rarely used.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1260

4- 203 - (240-20(d)-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After 240-20(c), add new Section as indicated:

"240-20(d) Grounded Conductors. No switch/overcurrent device shall be connected in series with any conductor that is intentionally grounded except where specifically required/permitted by this Code."

SUBSTANTIATION: Same as 4-95.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered in Sections 240-22 and 380-2(b). It is unnecessary to repeat it here.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2744

4- 204 - (240-21): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Add a second sentence:

"This shall include transformer secondary conductors unless otherwise specifically permitted elsewhere in this Code."

SUBSTANTIATION: I continually review sets of electrical plans that do not comply to the "tap rules" for transformer secondary conductors. There is widespread ignorance that these conductors generally must have over-current protection unless meeting a specific exception.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-174.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1652

4- 205 - (240-21, Exception No. 2): Reject

SUBMITTER: Philip C. Doolittle, Jr., Valparaiso, IN

RECOMMENDATION: Amend Section 240-21, Exception 2 by modifying it to read:

Exception No. 2: Feeder Taps Not Over 10 Feet (3.05 m) Long. For conductors tapped to a feeder or transformer secondary where all the following conditions are met.

a. The length of the tap conductors does not exceed 10 feet (3.05 m).

b. The ampacity of a factory installed tap conductor is:

(1) Not less than the combined computed loads on the circuits supplied by the tap conductors, and

(2a) Not less than the rating of the device supplied by the tap conductors, or

(2b) Not less than the rating of the overcurrent protective device at the termination of the tap conductors.

c. The ampacity of a field installed tap conductor is:

(1) Not less than the combined computed loads on the circuits supplied by the tap conductors, and

(2) Not less than the rating of the device supplied by the tap conductors, and

(3) Not less than the rating of the overcurrent device at the termination of the tap conductors.

d. The tap conductors do not extend beyond the switchboard, panelboard, or control devices they supply.

e. Except at the point of connection to the feeder, the tap conductors are enclosed in a raceway, which shall extend from the tap to the enclosure of an enclosed switchboard, panelboard, or control devices, or to the back of an open switchboard.

(FPN): See Section 384-16(a) for lighting and appliance branch-circuit panelboards.

SUBSTANTIATION: Current wording allows a field installation wherein a panel or device is tapped off the main in a switchboard or panelboard. Later, additional circuits or a larger device might be added, overloading the tap conductors and starting a fire. This proposal would reduce the chances of such hazards by making sure that field installed tap conductors terminate in an overcurrent device.

PANEL ACTION: Reject.

PANEL COMMENT: No documentation of a problem was submitted. This is an enforcement issue. Already covered in Section 220-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Gubany.

EXPLANATION OF VOTE:

GUBANY: I'm voting negative on panel action since I agree with the submitter. It is a fire hazard not to put a limitation on the tap. Most panelboards and switchboards come with provisions to add new circuits beyond the original load calculated for the panelboard or switchboard.

Log # 2745

4- 206 - (240-21, Exception No. 2, FPN): Accept

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Revise (FPN):

See Section 384-16(a) and (d) . . .".

SUBSTANTIATION: Please include FPN reference to Section 384-16(d) since that section clearly requires lighting and appliance branch-circuit panelboard protection on the secondary side of a transformer.

PANEL ACTION: Accept.

PANEL COMMENT: Editorial.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 91

4- 207 - (240-21, Exception No. 2 b. (1), (2a) and (2b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the item numbering in 240-21, Exception No. 2: b. (1), (2a) and (2b) as follows:

Change (2a) to "(2)".

Change (2b) to "(3)".

Leave remaining numbering unchanged.

SUBSTANTIATION: Clearly, the items (1), (2a) and (2b) are of equal rank and accordingly they should be identified in a logical and consistent manner in accordance with the 1978 NFPA Style Manual Chapter 2, 2-2.4.1.

PANEL ACTION: Reject.

PANEL COMMENT: Attention is called to the term "or" indicating equal emphasis.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1535

4- 208 - (240-21, Exception No. 2e-(New)): Accept in Part

SUBMITTER: Walter A. Mathews, St. Louis, MO

RECOMMENDATION: To Exception No. 2, add paragraph e:

"For field installation the overcurrent device on the line side of the tap conductor shall not exceed 1000 percent of the tap conductor's ampacity and terminate in a single overcurrent device."

SUBSTANTIATION: Field installations are more likely to result in a hazard since assurance of proper supervision is more difficult. A small conductor tapped to a feeder that has a very large overcurrent device could easily result in vaporizing the conductor and cause a burndown. Terminating in a single overcurrent device would limit the load to the ampacity of the tap.

The 25 foot tap rule is much safer than the present 10 foot tap rule. Putting a 1000% maximum for field installations would improve safety and reduce the risks of product liability.

PANEL ACTION: Accept in Part.

In the proposal delete "and terminate in a single overcurrent device." Add period after "ampacity".

PANEL COMMENT: The deleted words negate the principle of the 10-foot tap rule.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2178

4- 209 - (240-21, Exception No. 3): Reject

SUBMITTER: Vincent Cecil Metallo, Woodstock, MD

RECOMMENDATION: After the words tapped to a feeder, I would like to insert the words (or transformer secondary) and leave the remainder of the sentence the same.

SUBSTANTIATION: Because it is clearly stated in 240-21 EXCEPTION 2, that a 10' tap can be made off of a TRANSFORMER SECONDARY, it is not clearly stated if it can be made by 240-21 EXCEPTION 3, extending 25' off of a TRANSFORMER SECONDARY.

Because everyone uses the 25' TAP rule off of TRANSFORMER SECONDARIES, I would like to know if it is the intent of the CODE to limit the 25' TAP rule to Feeder conductors only, as presently stated, or can you use the 25' Tap rule for TRANSFORMER SECONDARIES.

PANEL ACTION: Reject.

PANEL COMMENT: The intent of the Panel is that Exception No. 8 be used when taps involve transformer secondaries.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 350

4- 210 - (240-21, Exception No. 8 b.): Reject

SUBMITTER: Jack Pullizzi, Pullizzi Electric

RECOMMENDATION: Revise as follows:

when multiplied by the ratio of the SECONDARY-to-PRIMARY voltage,

SUBSTANTIATION: Secondary-to-primary worded incorrectly should read primary-to-secondary.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter is technically incorrect.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 620

4- 211 - (240-21, Exception No. 8 d.): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add: "and are enclosed in a raceway".

SUBSTANTIATION: The tap conductors of this exception are essentially the same as Exception No. 3, and if safety warrants a raceway for those tap conductors, it is also warranted for transformer feeder taps. What is the essential difference?

PANEL ACTION: Reject.

PANEL COMMENT: This is adequately covered in present wording.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 92

4- 212 - (240-21, Exception No. 10 g.): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend Exception No. 10. g as indicated:

The tap shall "not" be made (no) less than 30 feet

SUBSTANTIATION: This change is required to conform to the 1984 NEC Style Manual, Part A, A-1c.

PANEL ACTION: Accept.

PANEL COMMENT: Editorial.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1129

4- 213 - (240-23): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line as indicated:

... of the grounded "(neutral)" conductor.

SUBSTANTIATION: Same as Proposal 4-100.

PANEL ACTION: Reject.

PANEL COMMENT: The grounded conductor may not always be a neutral.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 621

4- 214 - (240-24(a)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"... and shall be so installed that the center of the device(s) will not be more than 6-1/2 feet (1.98 m) above the floor or fixed standing surface."

SUBSTANTIATION: Fuses within switch assemblies and circuit breakers are required to be installed at a maximum height of 6-1/2 feet. "Readily accessible" is somewhat vague and subjective dependent upon the height of a person. It seems reasonable to provide a height limitation especially since fuses may not have a disconnect means or it is located remotely as permitted by Section 240-40. Section 710-24(1) appears to equate "readily accessible" with a 6-1/2 foot height maximum.

PANEL ACTION: Reject.

PANEL COMMENT: This is already covered by Section 380-8(a) and it is not necessary to repeat it.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3337

4- 215 - (240-24(b)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise to read:

"(b) Occupant to Have Access. Each occupant shall have access to all overcurrent devices protecting the conductors supplying that occupancy."

(The Exception would not be revised by this Proposal)

SUBSTANTIATION: From the definitions of Accessible and Readily Accessible in Article 100, it is clear that the term "Ready Access" is currently misused in this Section. Occupants need access; ready access is already guaranteed by 250-24(a). Use of "access", rather than "ready access" is further substantiated by the wording of the Exception.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel intends that a greater degree of accessibility be afforded the occupant.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 622

4- 216 - (240-24(b), Exception No. 2-(New)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add:
"Exception No. 2. As provided in Sections 230-92 and 230-93."
SUBSTANTIATION: To provide conformance with the referenced sections for single occupancy buildings not covered by the present exception, and for multiple occupancy buildings which do not comply with the exception.
PANEL ACTION: Reject.
PANEL COMMENT: Panel does not intend to proliferate the use of cross references.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2179

4- 217 - (240-24(d), Exception-(New)): Reject
SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH
RECOMMENDATION: New text:
240-24. LOCATION IN OR ON PREMISES.
d.) As presently stated.
EXCEPTION: Overcurrent devices in existing dwellings and structures, shall be permitted to be located just inside a closet entry if the location is such that a clear space of 6 inches to easily ignitable materials is maintained in front of such devices and the working space requirements of Section 110-16a. are provided.
SUBSTANTIATION: The construction and layout of Mobile Homes are much more restrictive and confining than in standard dwelling units. Most Mobile homes are pre-fabricated, manufactured industrialized units with very limited space available for equipment and storage. The hazard of storing combustible and easily ignitable material in close proximity of the overcurrent devices seem far greater in Mobile homes than in constructed dwelling units.
Therefore, I believe this exception could be utilized when re-modeling or altering existing dwellings and structures where relocating the service panel and overcurrent devices may present a hardship. If the 6 inch space is strictly maintained, I do not believe this proposal will jeopardize or endanger the safety of the occupants in these structures. I believe this is a practical safeguard for existing buildings and will not undermine the intent of the NEC.
PANEL ACTION: Reject.
PANEL COMMENT: The substantiation does not support the submitter's request for relief from the present requirement.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2180

4- 218 - (240-24(e)-(New)): Reject
SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH
RECOMMENDATION: New text:
240-24.) LOCATION IN OR ON PREMISES.
e.) DAMP LOCATIONS.
Overcurrent devices shall not be relocated in bathrooms, lockers, and similar locations where moisture and humidity are present in excessive amounts.
SUBSTANTIATION: I have had reason to inspect several existing dwelling units and other occupancies with panelboards and/or overcurrent devices installed in damp locations.
It appears that over a period of time, the moisture and humidity in these areas has caused portions of the busbars, and terminals to corrode and jeopardize the integrity of the equipment. This corrosion and deterioration of the equipment may cause a poor electrical connection which may result in a major problem arising.
This proposal is similar to the requirements found in Section 550-6a.) for Mobile Homes, but would encompass all installations and occupancies.
Aside from problems resulting from moisture and electricity, the overcurrent devices may not be readily accessible at all times, in the above mentioned locations.
I believe this Proposal would assist in eliminating potentially hazardous situations before they occur.

PANEL ACTION: Reject.
PANEL COMMENT: Too restrictive and conflicts with the definition of damp locations in Article 100.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1041

4- 219 - (240-30): Reject
SUBMITTER: Raymond W. Eckardt, Hot Springs Vil., Ark.
RECOMMENDATION: Revise as follows:
240-30 General. Overcurrent devices shall be enclosed in cabinets or cutout boxes access being provided by means of a door or swinging cover.
SUBSTANTIATION: In view of the definition of a cabinet (see proposal for revising definition) Section 240-30 Exception No. 3 doesn't make sense unless the basic rule states that a door shall be provided.
PANEL ACTION: Reject.
PANEL COMMENT: No substantiation was provided to limit access to overcurrent devices to hinged enclosures.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 720

4- 220 - (240-40): Reject
SUBMITTER: K. L. Paape, Asheville, NC
RECOMMENDATION: Delete the words "and Thermal Cutouts" from the title of Section 240-40 and the words "or thermal cutouts" from the first sentence (two places) of this section.
SUBSTANTIATION: Same as Proposal 4-195.
PANEL ACTION: Reject.
PANEL COMMENT: There may be other thermal cutouts than those referred to by the submitter.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 623

4- 221 - (240-40 and Exception No. 3-(New)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Revise as follows:
"A disconnecting means shall be provided on the supply side and immediately adjacent to all fuses or thermal cutouts in circuits of over 150 volts to ground and cartridge fuses in circuits of any voltage where accessible to other than qualified persons, so that each set of fuses or thermal cutouts can be independently disconnected from the source of supply.
Exception No. 3: A single disconnect means shall be permitted on the supply side of more than one set of fuses installed in a single enclosure for protection of utilization equipment."
SUBSTANTIATION: This proposal is for the safety of personnel where the circuit voltage is over 150 volts to ground and where cartridge fuses are accessible to unqualified persons who may not be aware of remote disconnect means permitted by this section. Even qualified persons may not search out remote disconnect means.
"Immediately adjacent" is used in Section 230-91(a); "adjacent" is used in Sections 422-8(d)(2) and 553-4. This term can be discerned as well as other numerous nonspecific words used throughout the Code which require judgements.
The words "individual circuits" presently used connotes a circuit supplying only one utilization equipment which infers this section doesn't apply to a general purpose or other circuit with more than one outlet.
PANEL ACTION: Reject.
PANEL COMMENT: There is no substantiation of a problem requiring a change in the requirement.
VOTE ON PANEL ACTION: Unanimously Affirmative.

4- 222 - (240-50(d)): Accept
SUBMITTER: CMP 4
RECOMMENDATION: In the heading and the first sentence change "live" to "energized".
SUBSTANTIATION: To comply with the NEC Style Manual.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 93

4- 223 - (240-53(a)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line of the sentence as follows:
 . . . and (0) "1" to 15 amperes, 16 to 20 amperes, and 21 to 30 amperes.
SUBSTANTIATION: There is no "0" ampere fuse but there is a one (1) ampere fuse. Please see Section 240-6, Exception.
PANEL ACTION: Reject.
PANEL COMMENT: Fuses less than (one) 1 ampere are available.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 94

4- 224 - (240-60(b)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the heading as indicated:
 (b) noninterchangeable - (0) "1"-6000 ampere . . .
SUBSTANTIATION: There is no "0" fuse but there is a one (1) ampere fuse. Please see Section 240-6, Exception.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-223.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 237

4- 225 - (240-60(b)): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the last line in the first sentence as indicated:
 . . . of the class to which (it) "the fuse" belongs.
SUBSTANTIATION: This change should be made to provide more meaningful clarity and definition of intent because it is not reasonably clear as to whether the phrase "of the class to which it belongs" refers to the fuse or the fuseholder.
PANEL ACTION: Accept.
PANEL COMMENT: Editorial.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1330

4- 226 - (240-60(b)): Reject
SUBMITTER: Duane McNamee, Phoenix, AZ
RECOMMENDATION: Change last sentence of Section 240-60(b) to read as follows:
 "Fuseholders for current-limiting fuses of a certain class shall not permit insertion of fuses of a different class."
SUBSTANTIATION: Many designs require Class RK-1 fuses for component protection. RK-5 fuses are easily substituted and protection is lost. Inspectors are aware of someone taking the RK-1 fuses from one job to the next job to get approval.
PANEL ACTION: Reject.
PANEL COMMENT: No substantiation provided. Equipment standards require evaluation of the worst case condition.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 238

4- 227 - (240-60(c)): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the fourth line in the sentence as indicated:
 . . . where applicable; "and" (5) the name or trademark . . .
SUBSTANTIATION: Editorial - to correct an apparent grammatical error.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1533

4- 228 - (240-60(c)(6)-(New)): Reject
SUBMITTER: Ronald H. Reed, Square D Company
RECOMMENDATION: Revise 240-60(c) to add a new subparagraph (6) as follows:
 (6) the type and voltage of the electrical system on which the fuse is listed for use.
SUBSTANTIATION: The present wording does not require marking to indicate the type and voltage of the electrical system (single or polyphase, grounded or ungrounded) on which the fuse is suitable for use. Therefore, existing fuse standards do not require interruption and short circuit testing on other than single phase circuits, resulting in a situation where approval testing does not relate to conditions of use on polyphase circuits. The revision to 240-60(c) will facilitate availability of fuses which have been tested and listed for use on polyphase as well as single phase systems.
PANEL ACTION: Reject.
PANEL COMMENT: This is an issue presently being resolved between product testing laboratories and the manufacturers.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1534

4- 229 - (240-61): Reject
SUBMITTER: Ronald H. Reed, Square D Company
RECOMMENDATION: Revise 240-61 as follows:
 240-61. Classification. Cartridge fuseholders shall be classified according to voltage and ampere ranges. Cartridge fuses shall be classified according to the type and voltage of the system on which the fuse is listed for use, and ampere range. Fuses rated 600 volts, nominal, or less, shall be permitted to be used for voltages at or below their ratings.
SUBSTANTIATION: The present wording does not require classification of fuses according to the type and voltage of the electrical system (single or polyphase, grounded or ungrounded) on which the fuse is listed for use. Therefore, existing fuse standards do not require interruption and short circuit testing on other than single phase circuits, resulting in a situation where approval testing does not relate to conditions of use on polyphase circuits. The revision to 240-61 will facilitate availability of fuses which have been tested and listed for use on polyphase as well as single phase systems.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 4-228.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 688

4- 230 - (240-81): Accept
SUBMITTER: Joseph S. Dador, Midway City, CA
RECOMMENDATION: Revise second paragraph to read:
 Where circuit breaker handles are operated vertically rather than rotationally or horizontally, the "up" position of the handle shall be the "on" position.
SUBSTANTIATION: Use of the words switchboards or panelboards can be interpreted that the code allows "upside-down" breakers in service equipment, motor control centers, load centers, and other product categories essentially the same as switchboards and panelboards except for their product listing. Safety dictates that various code articles agree on the concept that the up position is "on" for circuit breakers, where one cannot see the position of the switch blades. Section 380-7 added in the 1987 Code cycle would appear to apply to all applications, however, Section 380-11 makes reference to the requirements of Section 240-81, therefore, it seems that Section 240-81 should clearly state that in all cases, the "up" position shall be "on".
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 239

4- 231 - (240-82): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend Section as indicated:

240-82. Nontamperable. A circuit breaker shall be of such design that any "unauthorized" alteration of its trip point (calibration) or the time required for its operation will require dismantling of the device or breaking of a seal "period" (for other than intended adjustments).

SUBSTANTIATION: The phrase "for other than intended adjustments should be deleted because the "intent to adjust" may well be the main objective no matter what method is used to "access" the device.

PANEL ACTION: Reject.

PANEL COMMENT: This precludes the use of adjustable trip magnetic circuit breakers.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

FISCHER: I feel the panel comment should read as follows:

This proposal would preclude the use of the adjustable magnetic trip on circuit breakers which is an intended and necessary adjustment in many applications.

Log # 1748

4- 232 - (240-83(c)): Accept in Principle

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal.

It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 1-132. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Donald G. Fischer, Square D Company

RECOMMENDATION: Add the following to 240-83(c):

If the circuit breaker is intended to be used on a circuit having an available fault current higher than its marked rating by being connected on the load side of an acceptable overcurrent protective device having the higher rating, this additional series combination interrupting rating shall be marked on the end use equipment.

SUBSTANTIATION: The use of series combination ratings has been accepted by Underwriters Laboratories for a number of years. These additional ratings cannot appear on the circuit breakers. Therefore, this rating should be required to appear on the end use equipment, clearly identifying these ratings and the circuit breaker combinations necessary to obtain these ratings.

PANEL ACTION: Accept in Principle.

In the proposal change second word in the first sentence from "the" to "a".

In the first sentence delete "intended to be" between "is" and "on".

In the 3rd line add "interrupting" between "marked" and "rating".

PANEL COMMENT: Change in wording is for clarification.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Munson.

EXPLANATION OF VOTE:

MUNSON: The wording of this proposal covers too broad a scope.

The intent of the proposal applies to panel boards and load centers where a series arrangement of circuit breakers is used to achieve a certain fault current interrupting rating. As written the words "end use equipment" may be construed to mean the load connected to the circuit. Attempting to identify these series combinations on the myriad of products available in the field would be impossible. Enforcement would be impossible. The wording needs to be specific to panel boards and load centers.

Log # 1801

4- 233 - (240-83(c)(1)-(New)): Reject

SUBMITTER: Joel A. Rencsok, City of Phoenix, AZ

RECOMMENDATION: Add after "Exception" new paragraph:

(1) Circuit breakers that have an interrupting rating depending on the combination of another circuit breaker connected in series shall have this rating shown on the circuit breakers.

SUBSTANTIATION: Some manufacturers give two or more ratings to circuit breakers when they are used in a series-connected system to comply with NEC 110-9-10 and also NEC 230-65.

Many installations are being installed with no regard to what circuit breaker is installed down stream of a series-connected system and can cause a hazard if the series system is violated.

PANEL ACTION: Reject.

PANEL COMMENT: Conflicts with existing equipment standards.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Gubany.

EXPLANATION OF VOTE:

GUBANY: I am voting negative on panel action. I strongly agree with the submitter's substantiation. Many of these series rated circuit breakers are readily interchangeable with non-series rated CBs.

Log # 754

4- 234 - (240-83(d)): Reject

SUBMITTER: William A. Ronan, Wil., DE

RECOMMENDATION: Add to paragraph (d) as follows:

All spare or breakers added to the panels shall be "SWD" type.

SUBSTANTIATION: This will insure that any breaker to be used after original installation will be able to be used for such circuit switching.

PANEL ACTION: Reject.

PANEL COMMENT: "SWD" marking is an optional marking limited to 15- and 20-ampere circuit breakers.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1690

4- 235 - (240-83(d)): Accept

SUBMITTER: S. Griffin, Griffin Electric Co.

RECOMMENDATION: Change word "Approved" to "Listed" and delete words "for such switching duty".

SUBSTANTIATION: SWD Circuit Breakers are listed.

Removes redundant text.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3261

4- 236 - (240-83(d)): Reject

SUBMITTER: Michael L. Last, Tuxedo Park, NY

RECOMMENDATION: ADD:

"and other lighting circuits with reactive characteristics," after the current wording of ". . . fluorescent lighting circuits,"

SUBSTANTIATION: High Intensity Discharge lighting fixtures offer the same higher currents of operation, that is volt-amperes, as fluorescent lighting fixtures.

As such when circuit breakers are used as switches to control these types of circuits, they should also be approved for such switching duty and be of the SWD type.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation provided indicating a demonstrated need for this requirement.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2352

4- 237 - (240-83(e)-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 9 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Myron N. Daniels, US Navy Ship Yard Pearl Harbor, HI

RECOMMENDATION: Add new (e)

Where circuit breakers are back fed in panelboards as the first disconnect switch, that circuit breaker shall not rely on plug on or friction to secure the breaker in the panelboard. An additional approved/listed fastener shall be used to secure the circuit breaker in place.

SUBSTANTIATION: In several hundred units under my inspection - 100 amp circuit breakers were back fed. In two known instances, when live, the breaker came out while the worker was installing additional wires. According to U.L. several persons were either electrocuted or shocked in the East Coast, USA. This caused UL to change wording in UL 67 9.6 1986. (See UL ltr dtd 2 Feb 86 enclosed attached).

I have no objection to add this as a FPN in either 240 or 384 where installers, Inspectors will be advised & prevent the ungrounded conductors from hurting someone.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: This is under the jurisdiction of Panel 9.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2849, 2851

4- 238 - (240-83(e)-(New)): Accept in Principle

SUBMITTER: John L. Haydu, Allen-Bradley Company (2849)
Ronald H. Reimer, Allen-Bradley Company (2851)

RECOMMENDATION: Add new section to read as follows:

240-83(e) Voltage Marking

Circuit Breakers shall be marked to indicate the maximum voltage between two conductors in a circuit in which they may be used. On multipole devices, where different voltage ratings exist between phase to phase conductors and phase to grounded conductors, slash markings shall be used (e.g. 480Y/277, or 240/120).

SUBSTANTIATION: To establish circuit breaker voltage marking requirements in line with existing voltage definitions under Article 100.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 4-240.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3116

4- 239 - (240-83(e)-(New)): Accept in Principle

SUBMITTER: William E. Rose, Cooper Industries, Inc.

RECOMMENDATION: Add new Section to read as follows:

240-83(e) Voltage Marking

Circuit breakers shall be marked to indicate the maximum voltage between two conductors in a circuit in which they may be used. On multipole devices, where different voltage ratings exist between phase to phase conductors and phase to ground conductors, slash voltage markings (e.g. 480y/277V or 120/240V shall be used.

SUBSTANTIATION: To establish circuit breaker voltage marking requirements in line with existing voltage definitions under Article 100.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 4-240.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3298

4- 240 - (240-83(e)-(New) and FPN-(New)): Accept in Principle

Secretary's Note: The Correlating Committee directs the Panel to follow NFPA Manual of Style with respect to "and/or".

SUBMITTER: Charles E. Williams, Westinghouse Electric Corporation

RECOMMENDATION: Add new section and (FPN) to read as follows:

240-83(e) Voltage Marking

Circuit breakers shall be marked with a voltage rating corresponding to the nominal system voltage in which they are used that is indicative of their

capability to interrupt fault currents between phases and/or phase to ground.

FPN A circuit breaker with a straight voltage marking, e.g., 480V., may be applied in neutral grounded systems or grounded wye or grounded and ungrounded delta systems. Circuit breakers with slash voltage markings, e.g., 480Y/277V., 120/240V., may be applied only in grounded neutral systems.

SUBSTANTIATION: The above new section and (FPN) are required to establish circuit breaker voltage marking requirements in line with established voltage definitions in Article 100 and the requirements established in Sections 110-9 and 110-10, in addition, the (FPN) clearly establishes the application suitability of circuit breakers marked with either straight or slash voltage ratings.

PANEL ACTION: Accept in Principle.

Change "e.g." to "such as".

PANEL COMMENT: Change in wording for clarification.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1557

4- 241 - (240-84-(New)): Reject

SUBMITTER: Vince Saporita, Villa Ridge, MO

RECOMMENDATION: Add new Section 240-84:

240-84. Series Rated. Series rated circuit breakers shall not be installed on systems, or portions of systems, where an orderly shutdown is required.

SUBSTANTIATION: By definition, series rated systems cannot be selectively coordinated, and therefore should not be used where a blackout cannot be tolerated because of potential hazard(s) to personnel and equipment.

PANEL ACTION: Reject.

PANEL COMMENT: Where an orderly shutdown is required many other factors need to be taken into consideration and a totally engineered system designed for each unique need.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1642

4- 242 - (240-84-(New)): Reject

SUBMITTER: Larry Wharton, Pickerington, OH

RECOMMENDATION: Add:

240-84. Replacement Only. Circuit Breakers which have the same mounting dimensions as circuit breakers with lower voltage ratings shall be used only for replacement in existing installations where there is no evidence of improper voltage replacement or tampering. **SUBSTANTIATION:** 480 volt circuit breakers can easily be taken out and replaced with 240 volt circuit breakers. Substitutions of this type can occur simply because the N.E.C. has not addressed the issue. Let's remove this potential liability.

PANEL ACTION: Reject.

PANEL COMMENT: No documented evidence of problems was submitted with substantiation.

When a circuit breaker replacement is required a qualified electrician or maintenance man should be involved.

Circuit breakers and end use equipment are marked.

Anything can be a potential hazard whenever an unknowledgeable individual incorrectly applies any electrical product and does not follow instructions in accordance with Section 110-3(b).

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Herbert.

EXPLANATION OF VOTE:

HERBERT: I agree with the submitter. "Let's remove this potential liability".

Log # 1729

4- 243 - (240-84-(New)): Reject

SUBMITTER: Jack Adams, Carmel, IN

RECOMMENDATION: Add new Section 240-84 to read:

240-84 Current Limiting. Current limiting circuit breakers shall not be interchangeable with non-current limiting circuit breakers.

SUBSTANTIATION: Ads from c.b. manufacturers state that their new current limiting breakers are the same size as their standard breakers. That's fine as long as the standard breaker is being replaced by the current limiting breaker, but not vice-versa. A system designed with current limiting breakers would not be protected if standard breakers were used. See typical ad attached.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: No documented evidence of a problem was submitted with the substantiation. Circuit breakers are marked.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Gubany, Herbert.

EXPLANATION OF VOTE:

GUBANY: I'm voting negative on panel action. Interchangeability of C.L. CBs and non-current limiting CBs is a hazard to the public. A form of rejection should be used as with current limiting fuses or very clear warning markings on the equipment.

HERBERT: I agree with the submitter. When the possibility for error, ignorance, or carelessness can be avoided, we should adopt practices that will provide this protection.

Log # 1733

4- 244 - (240-84-(New)): Reject

SUBMITTER: Dave Bailey, Overland Park, KS

RECOMMENDATION: Add Section 240-84.

240-84 Series Rating. Series rated circuit breakers shall not be able to be replaced by circuit breakers which are not series rated.

SUBSTANTIATION: Since series ratings are becoming more popular, it is only a matter of time before a tragedy results from the replacement of a series rated circuit breaker by a nonseries rated circuit breaker.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action on Proposal 4-232.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 14

NEGATIVE: Gubany.

EXPLANATION OF VOTE:

GUBANY: Same as Proposal 4-243.

Log # 1951

4- 245 - (240-84-(New)): Reject

SUBMITTER: Scott Ottenberg, Plymouth, MN

RECOMMENDATION: Add:

240-84. Non-interchangeable. Circuit Breakers shall not be interchangeable with circuit breakers having a lower interrupting rating.

SUBSTANTIATION: It is currently possible to take out one manufacturer's breaker with a high interrupting rating and replace it with another manufacturer's breaker that has a lower interrupting rating. This practice should be eliminated through codes and standards. (See NEMA warning attached).

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action on Proposal 4-232.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Gubany, Herbert.

EXPLANATION OF VOTE:

GUBANY: I'm voting negative on panel action. NEMA has published a warning bulletin on the hazards of interchangeability of other manufacturer's CBs in the same equipment. It is also a hazard to be able to interchange high I.C. CBs with low I.C. CBs in the same panelboard.

HERBERT: Same as Proposal 2-243.

Log # 2850, 2852

4- 246 - (240-84-(New)): Accept in Principle

SUBMITTER: John L. Haydu, Allen-Bradley Company (2850)

Ronald H. Reimer, Allen-Bradley Company (2852)

RECOMMENDATION: Add new Section to read as follows:

240-84 Voltage Rating

Circuit breakers shall have a voltage rating that will satisfy the system voltage requirements under both single pole and multipole conditions.

FPN: The voltage rating indicates the circuit breaker's ability to interrupt current levels which may be present either due to faults between two phase to phase conductors or between one phase conductor and the grounded conductor.

SUBSTANTIATION: UL and ANSI circuit breaker standards have historically defined appropriate single pole and multipole performance requirements as defined in Section 110-10 of the Code. Straight voltage markings (e.g. 480V) and slash voltage markings (e.g. 480Y/277 and 120/240V) are markings that have been used to indicate the suitability of devices for safe application in specific system applications. A straight voltage rating has been used to indicate that a circuit breaker has been performance tested with phase to phase voltage tests across each single pole. Slash voltage ratings have been used to indicate that a circuit breaker has been performance tested with only phase to grounded conductor voltage tests across each single pole.

To ensure continued adequate circuit breaker performance characteristics and safe system applications, the above proposed Section 240-84 and companion marking section (Proposed 240-83(e)) to be added to the Code.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 4-240.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3117

4- 247 - (240-84-(New)): Accept in Principle

SUBMITTER: William E. Rose, Cooper Industries, Inc.

RECOMMENDATION: New text:

240-84 Voltage Rating

Circuit breakers shall have a voltage rating that will satisfy the system voltage requirements under both single pole and multipole conditions.

FPN: The manner in which the voltage rating is represented provides an indication of suitability for use on circuits which may be subject to faults between two phase conductors or between any phase conductor and the grounded conductor.

SUBSTANTIATION: UL and ANSI circuit breaker standards have historically defined appropriate single pole and multipole performance requirements as defined in Section 110-10 of the Code. Straight voltage markings (e.g. 480V) and slash voltage markings (e.g. 480Y/277V and 120/240V) are markings that have been used to indicate the suitability of devices for safe application in specific system applications. A straight voltage rating has been used to indicate that a circuit breaker has been performance tested with phase to phase voltage across each single pole. A slash voltage rating has been used to indicate that a circuit breaker has been performance tested with only phase to grounded conductor voltage across each single pole. To ensure continued adequate circuit breaker performance characteristics and safe system applications, the above proposed section 240-84 and companion marking Section (proposed 240-83(e)) should be added to the Code.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 4-240.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3338

4- 248 - (240-84-(New)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Add a new section as follows:

240-84. Circuit Breakers with Instantaneous Trip Only. Circuit breakers without inverse time overload characteristic and with instantaneous trip characteristic only shall be limited to the following uses:

(a) Motor Branch-Circuit Short-Circuit and Ground-Fault Protection. As provided in Section 430-52 and Table 430-152.

(b) Motor Control Center Main Breaker. An instantaneous trip circuit breaker shall be permitted as a main breaker for a motor control center, when provided with and mounted in the motor control center.

(FPN): An instantaneous trip circuit breaker is intended to be used for disconnection and short-circuit and ground-fault protection only.

SUBSTANTIATION: This proposal is submitted to set fourth in Article 240 the only legitimate uses for instantaneous trip only circuit breakers. Use under Section 430-52 and Table 430-152 is well established. Proposed use under the NEC as a motor control center main breaker is new, but the practice is in fact commonplace and safe. Substantial benefits would accrue to users, including better short-circuit coordination with upstream and downstream overcurrent devices (as opposed to use of an inverse-time breaker), and in providing a sensible safe alternative to the common, unsafe practice of using a molded case switch as a motor control center main disconnect.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation is incorrect. The coordination between an "instantaneous trip only" and a standard circuit breaker is the same.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 905

4- 249 - (Article 240, Part H, Title): Reject
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise title as follows:

H. Overcurrent Protection in Medium- And High-Voltage Systems.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

ARTICLE 250 -- GROUNDING

Log # 2727

5- 43 - (250-1, FPN-(New)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to paragraph 250-1 Scope:

"(FPN): For further information, see "IEEE Recommended Practice for Grounding Industrial and Commercial Power Systems, ANSI/IEEE Std 142-1982."

SUBSTANTIATION: Advising that the above reference is an available source will assist in avoiding problems due to multiple grounds, crossed neutrals and grounds, and in limiting overvoltages due to excessive ground impedances.

PANEL ACTION: Reject.

PANEL COMMENT: It is not possible or the intent to reference all documents.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Reardon.

EXPLANATION OF VOTE:

REARDON: There are numerous references to various Standards throughout the National Electrical Code. The proposed addition of a reference to ANSI/IEEE Std. 142 would be helpful to many users of the National Electrical Code.

Log # 906

5- 44 - (250-2): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise title of Article 710 and relocate alphabetically:

"Medium- And High-Voltage Systems . . . 710-3(b)(1)"

SUBSTANTIATION: Correlates with proposed change in title of Article 710.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Eldridge.

EXPLANATION OF VOTE:

ELDRIDGE: These proposals on voltages would affect the ratings and change practices and provide the potential for misinterpretation and misapplications in the field. They have been developed solely for consistency without consideration of the possible results of such changes.

Log # 1689

5- 45 - (250-2): Accept

SUBMITTER: S. Griffin, Griffin Electric Co.

RECOMMENDATION: Add "Electronic Computer" before "Data Processing Systems"

SUBSTANTIATION: Editorial. See Article 645

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1872

5- 46 - (250-2): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 13 for information.

SUBMITTER: David Houseman, Phoenix, AZ

RECOMMENDATION: Include transformers Article 450 in the list of other Articles.

SUBSTANTIATION: Transformers need to be grounded and should be included in the list with other Articles.

PANEL ACTION: Reject.

PANEL COMMENT: Section 250-2 is for articles that have requirements in addition to Article 250, Article 450 does not.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3457

5- 47 - (250-2): Reject

SUBMITTER: Don C. Jewett, The Upjohn Company

RECOMMENDATION: 250-2 Application of Other Article.

Change:	Article	Section
Class 1, Class 2, Class 3 Circuits		725-20
		725-43

Closed-Loop and Programmed Power	
Distribution	780-3

T0:	
Class 1, Class 2, Class 3 Circuits	725-20
	725-43

Intrinsically Safe Systems	725-80
Closed-Loop and Programmed Power	

Distribution	780-3
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SUBSTANTIATION: 250-2 Addition of article 725-80 of this proposal as source of information for grounding of intrinsically safe systems.

250-78 Normal equipment grounding practices are sufficient for wiring methods employed for intrinsically safe equipment installed in Hazardous (classified) Locations. Safety is assured by the design of equipment to be current limiting, and return of fault currents is not a requirement for system safety.

300-1 Added to include additional precautions when installing intrinsically safe equipment in Hazardous (classified) Locations, as provided for other electrical systems described in Chapter 7.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: It is not certain that this subject will be accepted by CMP 16, and will be reconsidered if they approve.

VOTE ON PANEL ACTION: Unanimously Affirmative.

(a) Motor Branch-Circuit Short-Circuit and Ground-Fault Protection. As provided in Section 430-52 and Table 430-152.

(b) Motor Control Center Main Breaker. An instantaneous trip circuit breaker shall be permitted as a main breaker for a motor control center, when provided with and mounted in the motor control center.

(FPN): An instantaneous trip circuit breaker is intended to be used for disconnection and short-circuit and ground-fault protection only.

SUBSTANTIATION: This proposal is submitted to set fourth in Article 240 the only legitimate uses for instantaneous trip only circuit breakers. Use under Section 430-52 and Table 430-152 is well established. Proposed use under the NEC as a motor control center main breaker is new, but the practice is in fact commonplace and safe. Substantial benefits would accrue to users, including better short-circuit coordination with upstream and downstream overcurrent devices (as opposed to use of an inverse-time breaker), and in providing a sensible safe alternative to the common, unsafe practice of using a molded case switch as a motor control center main disconnect.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation is incorrect. The coordination between an "instantaneous trip only" and a standard circuit breaker is the same.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 905

4- 249 - (Article 240, Part H, Title): Reject
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise title as follows:

H. Overcurrent Protection in Medium- And High-Voltage Systems.

SUBSTANTIATION: Same as Proposal 4-106.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 4-4.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 13

NEGATIVE: Carrick, Kassebaum.

EXPLANATION OF VOTE:

CARRICK: Same as Proposal 4-4.

KASSEBAUM: Same as Proposal 4-4.

ARTICLE 250 -- GROUNDING

Log # 2727

5- 43 - (250-1, FPN-(New)): Reject

SUBMITTER: R. G. Irvine, Suffern, NY

RECOMMENDATION: Add to paragraph 250-1 Scope:

"(FPN): For further information, see "IEEE Recommended Practice for Grounding Industrial and Commercial Power Systems, ANSI/IEEE Std 142-1982."

SUBSTANTIATION: Advising that the above reference is an available source will assist in avoiding problems due to multiple grounds, crossed neutrals and grounds, and in limiting overvoltages due to excessive ground impedances.

PANEL ACTION: Reject.

PANEL COMMENT: It is not possible or the intent to reference all documents.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Reardon.

EXPLANATION OF VOTE:

REARDON: There are numerous references to various Standards throughout the National Electrical Code. The proposed addition of a reference to ANSI/IEEE Std. 142 would be helpful to many users of the National Electrical Code.

Log # 906

5- 44 - (250-2): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise title of Article 710 and relocate alphabetically:

"Medium- And High-Voltage Systems . . . 710-3(b)(1)"

SUBSTANTIATION: Correlates with proposed change in title of Article 710.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Eldridge.

EXPLANATION OF VOTE:

ELDRIDGE: These proposals on voltages would affect the ratings and change practices and provide the potential for misinterpretation and misapplications in the field. They have been developed solely for consistency without consideration of the possible results of such changes.

Log # 1689

5- 45 - (250-2): Accept

SUBMITTER: S. Griffin, Griffin Electric Co.

RECOMMENDATION: Add "Electronic Computer" before "Data Processing Systems"

SUBSTANTIATION: Editorial. See Article 645

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1872

5- 46 - (250-2): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 13 for information.

SUBMITTER: David Houseman, Phoenix, AZ

RECOMMENDATION: Include transformers Article 450 in the list of other Articles.

SUBSTANTIATION: Transformers need to be grounded and should be included in the list with other Articles.

PANEL ACTION: Reject.

PANEL COMMENT: Section 250-2 is for articles that have requirements in addition to Article 250, Article 450 does not.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3457

5- 47 - (250-2): Reject

SUBMITTER: Don C. Jewett, The Upjohn Company

RECOMMENDATION: 250-2 Application of Other Article.

Change:	Article	Section
Class 1, Class 2, Class 3 Circuits		725-20
		725-43

Closed-Loop and Programmed Power	
Distribution	780-3

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SUBSTANTIATION: 250-2 Addition of article 725-80 of this proposal as source of information for grounding of intrinsically safe systems.

250-78 Normal equipment grounding practices are sufficient for wiring methods employed for intrinsically safe equipment installed in Hazardous (classified) Locations. Safety is assured by the design of equipment to be current limiting, and return of fault currents is not a requirement for system safety.

300-1 Added to include additional precautions when installing intrinsically safe equipment in Hazardous (classified) Locations, as provided for other electrical systems described in Chapter 7.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: It is not certain that this subject will be accepted by CMP 16, and will be reconsidered if they approve.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3160, 3322

5- 48 - (250-3(a), Exception No. 6-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 15 for information.

SUBMITTER: Brian W. Petcolas, Teledyne Inet (3160)
Bansi Patel, EPE, Inc. (3322)

RECOMMENDATION: New text:

Exception No. 6: Uninterruptible Power Supply Equipment using dedicated storage batteries.

SUBSTANTIATION: It appears that NEC does not have a consensus on the grounding of UPS systems as it varies for each Article and its application. This leaves the interpretation of NEC to the authority having jurisdiction, which in most cases is the electrical inspector.

The grounding of UPS DC battery supply circuits puts anyone entering the battery storage facility at risk. In many of the installations, a metal cabinet is used as a storage facility and the entire area surrounding the battery is at potential once a DC source is grounded. This will pose higher risk of shock hazard than ground potential if batteries are grounded and not floated.

NEC Section 705 - 50 (grounding) states: Interconnected electric power production sources shall be in accordance with Article 250, Part B and C, which includes Sections 250-3 through 250-26.

Exception: For direct-current systems connected through an inverter directly to a grounded service, other methods which accomplish equivalent system protection and which utilize equipment listed and identified for the use shall be permitted.

NEC Article 705 applies only to systems that are in parallel with the utility and can supply power to the source supply system.

It would seem that if a system meets grounding requirements in one application and then grounded consistently, the same should meet grounding requirements in similar applications. It would appear that there are many inconsistencies in the application of grounding requirements for DC supply systems.

Articles 690 through 705 are similar applications of an inverter system that has inconsistent grounding application directives.

Section 250-3 Exception 4 "A rectifier-derived DC system supplied from an AC system complying with Section 250-5." This exception would exempt UPS systems from the DC grounding requirement.

Article 100 Page 13 Definitions Premises wiring; " . . . such wiring does not include wiring internal to . . . and similar equipment (that includes a transformer as a part of the equipment)." This definition would label the DC supply systems as part of the internal wiring that is part of the electrical equipment and would exempt a UPS system from the DC grounding requirement.

In conclusion, without consideration for its inadequate definitions and grounding application inconsistencies, the incorporation of a DC supply circuit grounding requirement is creating a safety hazard, not eliminating the hazard or protecting technical personnel, which is against the intent of the code.

PANEL ACTION: Reject.

PANEL COMMENT: The exception has no restrictions on grounding of such systems, where special grounding rules are necessary, they are to be covered in the appropriate articles of Chapters 5, 6, and 7.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1700

5- 49 - (250-5, Exception-(New)): Reject

SUBMITTER: Charles M. Trout, Main Electric Co., Inc.

RECOMMENDATION: Add an Exception No. 1 after "Other circuits and systems shall be permitted to be grounded." as follows:

Exception No. 1: Three phase, three wire Delta systems having phase to phase voltage exceeding a nominal 240 volts shall not be permitted to have one phase grounded in a manner which would result in phase to ground voltage being equal to phase to phase voltage.

SUBSTANTIATION: Journeymen electricians and maintenance personnel are traditionally aware that, when working on or near energized equipment, accidental contact from phase to ground, while certainly shocking, is not necessarily injurious or fatal.

Allowing systems to be grounded in a manner that renders them as equally dangerous phase to ground as phase to phase puts these persons in potentially dangerous jeopardy and serves no purpose as outlined in Article 90-1.

PANEL ACTION: Reject.

PANEL COMMENT: 480-volt corner-grounded delta systems have been commonly used. The proposer has not substantiated any problems.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2591

5- 50 - (250-5(b)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Revise to read:

"(b) Alternating-Current Systems of 50 Volts to 1000 Volts. AC systems of 50 volts to 1000 volts supplying premises wiring and premises wiring systems shall be "solidly" grounded under any of the following conditions: (remainder of Section 250-5(b) and exceptions unchanged.)"

NOTE: Added Material In Quotations.

SUBSTANTIATION: Adding the word solidly in Section 250-5(b) would be consistent with the term solidly grounded in Sections 230-95 and 250-152 and would improve the clarity of Section 250-5(b). The intent is to require solid grounding of 50-1000 volts AC circuits except under the specific restrictions covered by exceptions 1-5 of this section.

PANEL ACTION: Reject.

PANEL COMMENT: "Solid" is redundant as implied by Sections 250-51, 250-53, and 250-79(a).

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Eldridge, McIntosh.

EXPLANATION OF VOTE:

ELDRIDGE: The word "solidly" as in "solidly grounded" is used in the NEC. See 230-95 line 2, 230-95b FPN#3, 250-5d line 3, 250-5d FPN#1; while it may be redundant it helps to explain the intent.

MCINTOSH: I believe the Panel Action should be changed to "accept". The use of the word "solidly" will help to clarify the intent.

Log # 2746

5- 51 - (250-5(b)(2)): Accept in Principle

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Revise to read: "Where the system is nominally rated 380 Y/220-volt or 480 Y/277-volt, . . ."

SUBSTANTIATION: Electrical utilization equipment from other countries requires other nominal voltage systems which Section 250-5(b) does not recognize. This revision will permit the authority having jurisdiction to require proper system grounding.

PANEL ACTION: Accept in Principle.

Revise the proposal to read as follows:

"Where the system is 3-phase, 4-wire, wye connected in which the neutral is used as a circuit conductor."

PANEL COMMENT: The Panel believes that all such systems should be grounded and the change is intended to be more generic.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MCINTOSH: The proposed substantiation is weak suggesting "other countries require other nominal voltage systems . . ." but only specifically mentioning 380Y/220-volt nominal systems. What "other nominal voltages" does the suggester have in mind if only one is specified in his proposal to change the NEC? Of course this wye system should be grounded for safety.

The subject here in Section 250-5(b) is safety "grounding" of systems that are 3-phase, 4-wire, wye-connected in which the neutral is used as a circuit conductor. Contrary to views expressed by some of our

Panel members I feel that acceptance of this proposal IS NOT FOR THE REASON OF increased sales or improved balance of trade between Europe and the USA. Increased sales of US manufactured goods or improved balance of trade is not the function of CMP-5.

Those familiar with the design and construction of many industrial facilities both in the USA and in other countries including Europe, utilizing USA manufactured equipment also equipment manufactured in "other countries", should point out to the general public studying this TCR that this acceptance is not a carte blanche acceptance of many other problems that the "authority having jurisdiction", and others, must be made aware. (There are undoubtedly many other references in the NEC to a nominal 480Y/277-volt system that need to be made more "generic" with the acceptance of this proposal.)

A 380Y/220-volt system, for example, is a 50 HERTZ system in Europe whereas a 480Y/277-volt system will be recognized in the USA as 60 HERTZ. The raceways and other electrical appurtenances on equipment manufactured in "other countries" and listed by testing laboratories in other countries are not necessarily "listed" as being acceptable in the USA. Many are not. The grounded conductor in many European countries may be required to be "blue" instead of "white or natural grey", for example. Also a 4-pole motor designed for 50 hertz and a synchronous speed of 1500rpm will operate at 1800 rpm on 60 hertz (i.e. speed being proportional to frequency). If the major excitation is held approximately constant (i.e. nearly constant volts/cycle) the excitation current may be within acceptable limits however the pump load (current) may change drastically with the new speed. All of these parameters must be considered in addition to proper grounding.

I believe the more generic description in the Panel Action may help ensure the system is at least properly grounded.

5- 52 - (250-5(b)(3)): Accept

SUBMITTER: CMP 5

RECOMMENDATION: Revise Section 250-5(b)(3) as follows:

"(3) Where the system is 3-phase, 4-wire delta connected in which the midpoint of one phase is used as a circuit conductor."

SUBSTANTIATION: The Panel believes that all such systems should be grounded and the change is intended to be more generic.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MCINTOSH: Same as Proposal 5-51.

Log # 240

5- 53 - (250-5(b)(4)): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend item (4) as indicated:

(4) Where a "grounded" service conductor is uninsulated in accordance with "the Exception to" Sections 230-22, 230-30, "and" 230-41.

SUBSTANTIATION: In the interest of safety, this change should be approved because where life-safety is involved the requirements should be more clearly defined. For example, Sections 230-22, 230-30 and 230-41 do not refer to "grounded service conductors"; however, the Exception to these sections does address "grounded service conductors."

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Sessler.

EXPLANATION OF VOTE:

SESSLER: The rule is a condition under which the system must be grounded. Inclusion of the word "grounded" in (b)(4) makes no sense since the system is then already grounded.

Log # 907

5- 54 - (250-5(b), Exception No. 3): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change "less than 1000 volts" to "1000 volts and less, nominal".

SUBSTANTIATION: For consistency with proposed definitions of low-, medium- and high-voltage circuits, equipment and systems (Article 100 proposals).

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Contingent on action of CMP 1 for voltages. CMP 5 has inserted "nominal" after "1000 volts" for clarification.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 624

5- 55 - (250-5(b), Exception No. 4): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Isolated systems as permitted or required in Articles 517 and 668."

SUBSTANTIATION: Isolated systems are permitted and required in Articles 517 and 668. Since Article 517 is noted, Article 668 should also be noted even though Section 90-3 applies. Why reference one article and not another?

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3323

5- 56 - (250-5(b), Exception No. 6-(New)): Reject

SUBMITTER: Bansi Patel, EPE, Inc.

RECOMMENDATION: New text:

Exception No. 6: Isolated systems as permitted in Article 645 and Section 90-6.

SUBSTANTIATION: The intent of Section 90-6 to relieve the inspection authority from the necessity of reexamining the equipment for its applicability. Section 110-3 defines the parameters, which, such equipment must meet to be considered to be in compliance with Section 90-6. Testing standards are developed from Section 110-3 requirements and equipment meeting these standards are therefore covered under Section 90-6.

PANEL ACTION: Reject.

PANEL COMMENT: There are no special rules in Article 645.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 908

5- 57 - (250-5(c), Heading): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise heading to read:

"Alternating-Current Systems Greater Than 1000 Volts".

SUBSTANTIATION: For consistency throughout the Code.

PANEL ACTION: Accept in Principle.

In the first sentence revise the words as follows:

"Alternating-current systems greater than 1000 volts supplying mobile or portable . . ."

PANEL COMMENT: To correlate title and text.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 625

5- 58 - (250-5(d), Exception-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: For the purposes of grounding, a premises wiring system(s) supplied from transformer secondary ties shall be considered a separately derived system(s)".

SUBSTANTIATION: The possible complexity of ground fault paths, length of conductors, uniqueness of such systems, shutdown/disconnection/maintenance of

transformers, switchboard units, and other equipment, and possible conflict with other Code rules should preclude such interconnected systems being considered as not separately derived, which permits one system grounding/bonding point.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that proposal is not an exception to the rule. The proposer's intent is not clear.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2747

5- 59 - (250-5(e)-(New)): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: New text:

Alternating-Current-Conditioning Systems.
AC-Conditioning systems such as isolating transformers, filtering systems, uninterruptable power supplies, etc., shall be grounded if required to be grounded as in (d) above.

SUBSTANTIATION: Obviously some data processing and some electronics manufacturers and installers see little need or reason to provide safe grounding of systems and equipment. This proposal will allow the authority having jurisdiction to enforce safety.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is redundant, these systems are required to be grounded in accordance with Article 250.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 626

5- 60 - (250-7(b)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add: "and 668".

SUBSTANTIATION: Since articles covered by Section 90-3 are indicated in (a) and (b) Article 668 should be included for consistency. Why reference some articles and not others?

PANEL ACTION: Reject.

PANEL COMMENT: The reference Section 668-11(a) does not prohibit grounding.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2863

5- 61 - (250-21(d)-(New)): Accept in Principle

SUBMITTER: Warren H. Lewis, Lewis Consulting and Engineering

RECOMMENDATION: Section 250-21 OBJECTIONABLE CURRENT OVER GROUNDING CONDUCTORS.

It is proposed that the Section be amended to reflect the continued requirement of the NEC to maintain low impedance ground-fault current paths and to maintain the integrity of the Equipment Safety Grounding Conductor (ESGC; i.e., "greenwire") and metallic raceway safety grounding/bonding paths where "objectionable current flows" in the form of electrical "noise" are of concern to those installing, operating and maintaining sensitive electronic systems such as Electronic Computer/Data Processing Equipment Systems.

It is intended that the existing wording of Section 250-21 not be used as justification for the common practice of placing insulating sections and/or fittings in metallic conduits in violation of Section 300-10, for disconnecting (or not installing) required Equipment Safety Grounding Conductors (ESGC; i.e., "greenwires") per Sections 250-57 and 250-59, or for failing to properly provide for ac system grounding as required by Section 250-23 for services, and 250-26 for separately derived systems. General protection from violations of Sections 110-10, 250-50 and 250-51 are also desired by this change.

Accordingly, the following text (in quotations) is requested to be added to the present wording of Section 250-21 as a new paragraph (D).

"The provisions of this section shall not be interpreted as permitting Electronic Computer/Data Processing Equipment (or any other equipment) being operated on ac systems or branch circuits which are not effectively grounded/bonded per the specific requirements of Sections 110-10, 250-23, 250-26, 250-57, 250-59, or 300-10, or any other applicable requirements of the code. The permission to alter the grounding of the electrical wiring system as given in this section is only provided so long as the grounding other applicable requirements of the code are not ignored. The removal of grounding conductors and connections permitted in this section may only be applied to those grounding conductors and connections which are not required by Article 250, but which were optional to the installer in the original instance."

SUBSTANTIATION: Numerous installers, operators and maintainers of sensitive electronic systems such as Electronic Computer/Data Processing Equipment Systems believe that the foregoing sections of the NEC may be safely disregarded by invoking the exceptions provided in Section 250-21 re objectionable current flows and the permitted grounding modifications suggested, but not clearly described within the section.

Because the subject section does not specifically state that the electrical safety grounding requirements of the NEC are still required to be fully met by all electrical equipment and ac system installations, it may be inferred that they do not. Unsafe and bizarre modifications to the electrical systems supporting such equipment therefore result from the misguided actions of those so interpreting this section. Other, tortuous interpretations of the NEC are also used to effectively advance the same concepts found in Section 250-21 as may be found in supporting reference material Exhibit (2) which lead to unsafe grounding.

Typical NEC problems also result from the practice of introducing plastic insulating bushings and other non-metallic sections of raceway into the terminations of conduits to equipment. At other times, the Equipment Safety Grounding Conductor (ESGC; i.e., "greenwire") is either disconnected or routed externally to the raceway system to isolated earth and other forms of grounding electrodes or to other equipment also incorrectly grounded. AC systems supporting such equipment are therefore sometimes installed and operated with ungrounded secondaries on transformers, Motor-Alternator (MA) sets, and inverters. Connections of these ac supply systems into isolated earth and other grounding electrodes is also commonplace.

Three limited, references to some of these typically reoccurring and unwanted practices are as follows and are provided as accompanying exhibits to this application:

(1) EMC Technology Magazine Jan-Feb 1986, page 30, Figure-2, where the use of an insulating "dielectric" nipple is shown on the conduit of a branch circuit supplied by the secondary of an "isolation" transformer-originated separately derived ac system. A faulted primary winding is not provided with a proper ground-fault current path in this example.

(2) EC&M Magazine June 1987, page 69, figure 3 where an isolation transformer is recommended to have its enclosure and secondary insulated from the building's grounding system in complete fashion except by an earth return path. This practice is also strongly promulgated by many of the manufacturers of isolation transformers, particularly those prefixed with the word "ultra" or something similar to it. These vendors are supplying ungrounded isolation transformers with supporting installation instructions for providing COMPLETELY ungrounded secondary outputs, in epidemic proportions. The drawing in referenced figure-3 is apparently taken verbatim from one such manufacturer's catalog.

(3) EMC Technology Magazine, Sept.-Oct. 1987, page 38, figure-9, where the use of a completely ungrounded isolation transformer enclosure is shown as being popular with many installers of such equipment. Warnings in the text notwithstanding, the approach is apparently tacitly recommended as a way to reduce electrical "noise" if you're willing to live with the hazards created.

Although NEC Section 645-4 requires compliance with all grounding provisions of Article 250, the effect of this section is seriously compromised by the Article's application to computer rooms covered by the Article only. The grounding requirements for Electronic Computer/Data Processing Equipment installed in other locations is not so clearly described. In any case, Section 645-4 still allows the Section 250-21 to be quoted and misused.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

The described problem is one of serious magnitude and of growing proportions. The NEC is required to be clarified in this regard to make it even more difficult for people to make misinterpretations of it.

While it may be argued that an electrical inspection would result in the aforementioned violations being discovered and being ordered to be corrected, it is naive to believe that all such installations are inspected, or that the modifications don't occur subsequent to the inspection effort. Since many persons read and attempt to use the NEC without benefit of required electrical inspections, it seems reasonable to clarify the NEC so that they will not make well-intentioned errors in interpreting it. Those bent on misinterpreting or disregarding the NEC are not preliminarily affected by anything written into the NEC, but are often subsequently deterred and held responsible by being caught in product safety and injury liability litigation. In these cases a clearly worded NEC can go a long way towards reducing their chances for a successful defence of their actions.

PANEL ACTION: Accept in Principle.

Revise the proposal to read as follows:

"(d) Limitations to Permissible Alterations. The provisions of this section shall not be considered as permitting electronic computer/data processing equipment being operated on ac systems or branch circuits which are not grounded as required by this article. Currents that introduce noise or data errors in electronic equipment shall not be considered the objectionable currents addressed in this section."

PANEL COMMENT: The Panel believes that the reworded proposal satisfies the intent of the proposer and conforms to the NFPA Style Manual.

The proposal prevents abuses of the permission to make alterations in grounding requirements. The specific requirements insure: that the ground path will be adequate to operate circuit protective device during a fault; that the system will be grounded if required; that exposed noncurrent-carrying parts will be grounded; that the earth will not be the sole equipment grounding conductor; and, that metal raceways will be continuous from enclosure to enclosure.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Skuggevig.

EXPLANATION OF VOTE:

SKUGGEVIG: The words "computer data processing" in the first sentence after the title should be deleted. The problem addressed by the new wording involves all electronic equipment, and not just computer data processing equipment.

COMMENT ON VOTE:

SESSLER: With regards to the last sentence of the Panel Comment, it should be noted that in Prop 5-158 (250-75 Ex New) the Panel accepted a provision which would allow a discontinuity between a raceway and an enclosure for EMI reduction.

5- 62 - (250-22, Exception): Accept

SUBMITTER: CMP 5

RECOMMENDATION: Revise the exception to Section 250-22 as follows:

Exception: Where the dc system source is located on the premises a grounding connection shall be made either (1) at the source or the first system disconnecting means or overcurrent device, or (2) by another means which accomplishes equivalent system protection and which utilizes equipment listed and identified for the use.

SUBSTANTIATION: Where a dc system is connected via premises wiring to sensitive electronic equipment containing circuitry which must be grounded for functional as well as safety reasons, the required ground at the dc source or disconnecting means or overcurrent device, creates a path for dc load current through equipment grounding paths including building steel, etc. which can cause galvanic corrosion and other possibly undesirable effects. The proposed revision to the exception to Section 250-22 will permit the means to achieve equivalent protection for the system, facilitate operation with proper grounding, and eliminate dc load currents in the building structure.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1130

5- 63 - (250-23(a), Exceptions No. 1, 2 and 4): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second and fourth lines in the second sentence, the third line in the third sentence, the second line in the fourth sentence, the second line in Exception No. 1, the first line in Exception No. 2 and the fourth line in Exception No. 4 as indicated:

... the grounded "(neutral)" service ... the grounded "(neutral)" service conductor ... the grounded "(neutral)" service conductor ... grounded "(neutral)" circuit ... the grounded "(neutral)" conductor ... the grounded "(neutral)" circuit ...

SUBSTANTIATION: Same as Proposal 5-1.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2595

5- 64 - (250-23(a), Exception No. 7-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add an exception No. 7 to read:

"If a multi-section switchboard serves as the service equipment, the grounding electrode conductor connector shall be permitted to be located in any section of the same switchboard provided: (1) the grounding electrode conductor connector is located electrically on the supply side of the grounded conductor disconnecting means; and (2) the section containing it is marked to show that the grounding electrode conductor connector is located within that section."

SUBSTANTIATION: New exception No. 7 for Section 250-23(a) is intended to clarify that in a multi-section switchboard the grounding electrode conductor connector may be located in a section other than the main section. Some switchboards have 6 sections each containing a service disconnect as permitted by Section 230-71(a).

The ANSI Standard for Dead Front Switchboards UL 891 and the Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear UL 1558 allow the grounding electrode conductor connector to be in a section other than the main section if the sections are manufactured as a group to constitute a single switchboard. Each section of such a group is identified with a section number showing its intended location when assembled at the site.

Electrically a switchboard is the same whether it is constructed as a single section or as a multi-section switchboard. Locating the grounding electrode conductor connector in the section adjacent to the main allows it to be inspected without being exposed to live bus bars on the line side of the main and without the need to break a utility seal. Marking the section of the switchboard that contains the grounding electrode conductor connector would facilitate such inspection of the switchboard after installation.

PANEL ACTION: Reject.

PANEL COMMENT: Item (1) is presently covered by the Code. There is no need to mark this particular configuration as opposed to others.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1962

5- 65 - (250-23, FPN-(New)): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal with reference to location of new FPN. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Olaf G. Ferm, Ferm's Fast Finder Index

RECOMMENDATION: Add a (FPN) See section 310-4.

SUBSTANTIATION: To indicate neutrals in parallel can not be smaller than 1/0

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MCINTOSH: The letter "S" at the beginning of the Recommendation should be capitalized to agree with the Style Manual.

Log # 9

5- 66 - (250-23(b)): Accept in Principle

Secretary's Note: The following proposal consists of Comment 5-18 on Proposal 5-37 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 5-37 was to change to read as follows:

"Where an ac system operating at less than 1000 volts is grounded at any point, the grounded conductors shall be run to each service and/or service overcurrent disconnecting means . . ."
(continued as written)

SUBMITTER: L. H. Sessler, Morristown, NJ

RECOMMENDATION: Reconsider Panel Action to reject.

SUBSTANTIATION: I believe this issue should be revisited. Although a specific condition could exist as cited in the Panel Comment making it unnecessary to run a neutral to each service disconnect, the bonding and grounding rules for such an installation are very specific. If instead of grounding at a gutter, the choice is to ground each (up to 6) disconnect, what are the proper rules and is it appropriate to not bring the neutral to each disconnect. Spelling out all of the conditions and rules is very cumbersome, but without such details, there is a high probability that an improper and unsafe installation will be made. The simple solution is to accept the proposal.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 5-67.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 67 - (250-23(b)): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal to clarify whether the revised text replaces the whole paragraph or only the first sentence, and correlate with Panel Action on Proposal 5-69. This action will be considered by the Panel as a Public Comment.

SUBMITTER: CMP 5

RECOMMENDATION: Revised text:

250-23(b) Grounded Conductor Brought to Service Equipment. Where an ac system operating at less than 1000 volts is grounded at any point, the grounded conductor shall be run to each service and service overcurrent device or devices and bonded to their enclosures.

SUBSTANTIATION: It is the intent of the subcommittee to require the same reliable ground-fault current path for a service consisting of multiple disconnects as one with only a single disconnect. The unanimous feeling of the subcommittee members is that the service from a grounded system is best protected by having the grounded conductor serve as the major return current path for ground-fault current.

Section 250-51. Effective Grounding Path. States that the path to ground from circuits, equipment, and conductor enclosures shall: (1) . . . (2) . . . (3) have sufficiently low impedance to limit the voltage to

ground and to facilitate the operation of the circuit protective devices in the circuit from a design and engineering aspect this code change will tend to optimize 250-51(3).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

SESSLER: This is a major change requiring the grounded circuit conductor to be terminated and bonded to each disconnecting means, including one not requiring neutral load.

For clarification the wording should be revised to indicate that the grounded conductor is to be run to each service disconnecting means and bonded to its enclosure. This change provides a uniform method of grounding services with multiple disconnects.

Log # 627

5- 68 - (250-23(b)): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add: "equipment" or alternatively, "disconnecting means" after "service" in the first sentence.

SUBSTANTIATION: "Service equipment" or "service disconnecting means" as used in the heading and Section 250-24(a) is more definitive.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 5-67.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 909

5- 69 - (250-23(b)): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: In second line change "less than 1000 volts" to "1000 volts and less, nominal".

SUBSTANTIATION: Same as Proposal 5-54.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Comment for Proposal 5-54.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1985,

5- 70 - (250-23(b)): Reject

Secretary's Note: The Correlating Committee advises the Panel that the Correlating Committee has directed "kcmil" become the standard term. This action will be considered by the Panel as a Public Comment.

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: In the second sentence, change "MCM" to "kcmil" in two places.

SUBSTANTIATION: The correct designation for the area of a conductor is cmil (circular mil) or kcmil (1,000 circular mils) and should be used when defining conductors larger than 4/0 AWG. "M" is the Roman designation for 1,000 while "k" is the English designation.

ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms, includes circular mil and all new IEEE Standards use the kcmil designation. Underwriters Laboratories and the Insulated Cable Engineers Association (ICEA) have also changed from the MCM designation to kcmil. It is important for consistency that the NEC also change to the kcmil designation.

Similar proposals are being submitted for all affected Sections of the NEC.

PANEL ACTION: Reject.

PANEL COMMENT: This proposal could be accepted if "kcmil" is used throughout the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MCINTOSH: The NFPA National Electrical Code Style Manual - October 1984 still uses the designation MCM for "thousand circular mils".

Log # 2181

5- 71 - (250-23(b)): Reject
SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH
RECOMMENDATION: Revised text:
 250-23 b.) GROUNDED CONDUCTOR BROUGHT TO SERVICE EQUIPMENT.

Last sentence (new in NEC 1987).

Change . . . "the size of the grounded conductor . . ."
 to read: " . . . the size of EACH grounded conductor. . ."

SUBSTANTIATION: 1. Several contractors, engineers, etc. whose work I inspect, frequently calculate and believe the TOTAL area of grounded conductors in parallel are to equal 12 1/2 per cent.

2. It is my understanding EACH grounded conductors is to be sized in accordance with this requirement when these conductors are installed in parallel.

3. I believe this Proposal will help eliminate a great deal of the confusion I have encountered attempting to enforce this requirement. The Proposal will clarify and be more explicit as to how to calculate and size these conductors.

PANEL ACTION: Reject.

PANEL COMMENT: It is the intent of the Panel that the total area of the grounded conductor be sized in accordance with these requirements and not sized according to the individual conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2298

5- 72 - (250-23(b)): Reject
SUBMITTER: Arthur Freund, Electrical Construction and Maintenance Magazine
RECOMMENDATION: Revise last sentence of Sec. 250-23(b) to read as follows (added text in quotations);

Where the service phase conductors are paralleled, the size of the grounded conductor shall be based on the equivalent area for parallel conductors as indicated in this section, "and a full-size grounded conductor shall be run in each raceway or cable."

(Remaining text and Exceptions 1 and 2 to remain unchanged.)

SUBSTANTIATION: There is disagreement among the authorities having jurisdiction as to whether the grounded conductor, when sized as required in this section, must be run full-size with each set of parallel conductors or may be divided in cross section among the several sets, subject only to the minimum of No. 1/0 AWG for parallel conductors.

Since the grounded conductor, in this instance, is performing as an equipment bonding conductor on the supply side of the service and main bonding jumper, it should run full-size in parallel, as required for such a bonding conductor in Section 250-79(c).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-71.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1023

5- 73 - (250-23(b) and Exception No. 1): Accept
SUBMITTER: Raymond W. Eckardt, Hot Springs Vil., Ark.
RECOMMENDATION: Change "service phase conductor", "phase conductor" and "service conductor" to "service-entrance phase conductor" in the sixth and eighth (two places) lines of the section and in Exception No. 1.

SUBSTANTIATION: Table 250-94 only tabulates service entrance conductor sizes. With this change the wording will be similar to Section 250-79(c) and will be less confusing where service drop and service lateral conductors of smaller size are involved. See Sections 230-23(c) and 230-31(c).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1024

5- 74 - (250-23(b), Exception No. 1): Accept
SUBMITTER: Raymond W. Eckardt, Hot Springs Vil., Ark.
RECOMMENDATION: Delete the phrase "or equivalent area for parallel conductors".

SUBSTANTIATION: The basic reason for Exception No. 1 is that table 250-94 would otherwise require a No. 8 copper or No. 6 aluminum grounding electrode conductor where service entrance conductor sizes are of a smaller size. Conductors in parallel are not permitted in these sizes for service entrance conductors and no cases exist where the phase requested to be deleted is necessary.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

SESSLER: Correct spelling of "phase" to "phrase" in the substantiation.

Log # 1131

5- 75 - (250-23(b) and Exception No. 1): Reject
SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in the first sentence, the fifth line in the second sentence, the second line in the third sentence and the first line in Exception No. 1 as indicated:

. . . grounded "(neutral)" conductor shall . . . the grounded "(neutral)" conductor shall not . . . of the grounded "(neutral)" conductor shall be . . . grounded "(neutral)" conductor shall not be required . . .

SUBSTANTIATION: Same as Proposal 5-1.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3339

5- 76 - (250-23(b), Exception No. 2-(New)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Add a new Exception, as follows:

Exception No. 3: For a separately derived system operating at less than 1000 volts and grounded beyond the source in accordance with Section 250-26(b), the requirements of Section 250-23(b) shall apply between the source and the grounding point.

SUBSTANTIATION: For a separately derived system so grounded, the source-side grounded conductor will constitute a capable ground-fault return path if extended in adequate size as proposed.

PANEL ACTION: Reject.

PANEL COMMENT: Separately derived systems are not services. The subject is covered in Section 250-26 and in particular Section 250-26(d).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1132

5- 77 - (250-24 and Exception No. 2): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the fifth line in the first sentence and the first line in the first sentence in Exception No. 2 as indicated:

. . . system grounded "(neutral)" circuit conductor . . .

. . . grounded "(neutral)" circuit conductor connection to . . .

SUBSTANTIATION: Same as Proposal 5-1.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1521

5- 78 - (250-24(a)): Reject

SUBMITTER: R. P. O'Riley, Innovative Education, Inc.

RECOMMENDATION: Add the word "system" after grounding electrode.

Suggested reading . . . the grounding system in each building or structure shall have a grounding electrode system as described in Part H, etc.

SUBSTANTIATION: By the use of only the term "grounding electrode," a metal water pipe could be considered as an acceptable grounding electrode.

If it is the desire of the Code that a grounding electrode system be established at the second building, this would make it very clear.

PANEL ACTION: Reject.

PANEL COMMENT: The addition of the word "system" leaves the reader with unintended additional requirements.

Section 250-24(a) applies to two or more buildings or structures supplied from a common service. Each building or structure is to have a grounding electrode such as described in Section 250-81(a), or Sections 250-81(b), (c), (d) or Section 250-83. In many situations the grounding electrode is a ground rod.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1394

5- 79 - (250-24(a), Exceptions No. 1 and 2): Reject

SUBMITTER: George B. Wiggin, Lusby, MD

RECOMMENDATION: Delete exceptions 1 and 2 from paragraph (a).

SUBSTANTIATION: The heading of 250-24 accurately identifies the conditions for grounding that are described in paragraph (a).

The exceptions describe a requirement for grounding where one (1) or more buildings are supplied from another building.

These requirements should be addressed by a completely new proposal and section.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is not complete. There is no technical justification, nor does the proposal state where the new section should be located.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 629

5- 80 - (250-24(a), Exception No. 2): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"A grounded circuit conductor connection to the grounding electrode shall not be made where an equipment grounding conductor . . .".

SUBSTANTIATION: This exception as written permits a parallel installation of the grounded circuit conductor and the equipment grounding conductor which may be unequal in size. This can result in a voltage gradient, circulating current flow, and current flow in the grounding electrode conductor. Where this can be avoided, as where the supply conductors are not in a metal raceway or cable the Code should so require.

How can such installation comply with Section 250-21(a)? If objectional currents are perceived may the bonding/grounding be disconnected per Section 250-21(b)?

PANEL ACTION: Reject.

PANEL COMMENT: If the proposal were accepted, the basic rule could not be utilized where an incidental equipment grounding conductor, for example metal conduit, is used for a feeder.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Skuggevig.

EXPLANATION OF VOTE:

SKUGGEVIG: When an equipment grounding conductor is run to the second building or structure, there is little technical difference between regrounding the grounded circuit conductor at the second building or anywhere else in the premises wiring system. The grounded conductor is regrounded in violation of the intent of Section 250-23(a). If an equipment grounding conductor is run with the feeder to the second building, there is no justification for this violation which promotes the conduction of load currents on equipment grounding paths.

Log # 2308

5- 81 - (250-24(a), Exception No. 2): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 19 for information.

SUBMITTER: W. A. Ross, Haverhill, MA

RECOMMENDATION: Delete the last sentence of Exception No. 2:

Replace with (FPN) as follows:

(FPN): Where livestock is housed, see Section 547-8.

SUBSTANTIATION: Many users of the Code have been burned when using the more popular 250-24 only to find that the provisions of 547-8 are different, e.g. "the equipment grounding conductor is to be the same size as the circuit conductors," and 547-8 prevails.

It's good Code to spell the provisions out in one place and have other Articles refer to it.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not agree with the substantiation. Section 547-8(a), Exception d. does not address the equipment grounding conductor specified in this section.

Panel 19 is addressing the issue.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 10

5- 82 - (250-24(a), Exception No. 3-(New); 250-24(b), Exception No. 3-(New)): Accept in Principle

Secretary's Note: See Correlating Committee action on Proposal 5-86.

Secretary's Note: The following proposal consists of Comment 5-24 on Proposal 5-41 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 5-41 was to revise Section 250-24 as follows:

In 250-24(a), Exception No. 2, insert a new second sentence, "Where there are no existing electrodes, a grounding electrode meeting the requirements of Part H shall be installed where the building or structure supplies more than one branch circuit."

Add a new 250-24(b), Exception No. 2 as follows:

"Exception No. 2: A grounding electrode and grounding electrode conductor connection to the metal enclosure of the building or structure disconnecting means shall not be required provided all of the following conditions are met.

1. An equipment grounding conductor is run with the circuit conductors to the building or structure disconnecting means for grounding any noncurrent-carrying equipment, interior metal piping systems and building or structural metal frames.

2. There are no existing grounding electrodes as described in Part H.

3. The building or structure supplies only one branch circuit.

4. Where livestock is housed, that portion of the equipment grounding conductor run to the disconnecting means shall be insulated or covered copper.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Accept proposal revised as follows:

Add new Exception No. 3 to (a) and (b).

Exception No. 3: Where the building or structure disconnecting means is located as permitted in Section 230-84(a), Exceptions No. 1 and 2.

SUBSTANTIATION: This proposal does not appear to cover the condition where a building or structure disconnecting means is permitted to be located elsewhere on the premises as covered in Section 230-84(a), Exceptions No. 1 and 2 for industrial premises. The two sections appear to be at variance with each other.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Panel believes the submitter's intent is accomplished by Panel Action on Proposal 5-86.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Skuggevig.

EXPLANATION OF VOTE:

SKUGGEVIG: Same as Proposal 5-86.

5- 83 - (250-24(a), Exception No. 3-(New) and Exception No. 4-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add a new exception No. 3 to read:

"As covered by exception No. 5 of Section 250-5(b) and Section 250-27 for high-impedance grounded neutral systems grounding connection requirements."

Add a new exception No. 4 to read: "If a multi-section switchboard serves as the building disconnecting means, the grounding electrode conductor connectors shall be permitted to be located in any section of the same switchboard provided: (1) the section containing it is clearly marked to show that the grounding electrode conductor connector is located within that section; and (2) the grounding electrode conductor connector and bonding jumper are located on the supply side of the grounded conductor disconnecting means, if provided."

SUBSTANTIATION: Reference to Section 250-27 and exception No. 5 of Section 250-5(b) is needed as exception No. 3 for Section 250-24(a), since a high impedance grounded neutral system could be used at a second building and Section 250-27(c) precludes solidly grounding by a main bonding jumper or by a directly connected grounding electrode conductor.

New exception No. 4 for Section 250-24(a) is intended to clarify that in a multi-section switchboard the grounding electrode conductor connector and bonding jumper may be located in a section other than the main section.

The ANSI Standard for the Dead Front Switchboards UL 891 and the Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear UL 1558 allow the grounding electrode conductor connector and bonding jumper to be in a section other than the main section if the sections are manufactured as a group to constitute a single switchboard. Each section of such a group is identified with a section number showing its intended location when assembled at the site.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-64.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 84 - (250-24(a), FPN-(New)): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"FPN. Section 547-8 for agricultural buildings housing livestock."

SUBSTANTIATION: Outbuildings housing livestock, covered by Article 547 may have different grounding requirements in the exception to Section 547-8, i.e., same ownership, equipment grounding conductor the same size as the circuit conductors.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Panel believes the acceptance of Proposal 5-85 provides a more complete reference.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 85 - (250-24(a) & (b), Exception No. 2, FPN-(New)): Accept

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.

RECOMMENDATION: Insert the following (FPN) after Exception No. 2 in both parts.

(FPN): See Section 547-8(a) Exception, for special grounding requirements for agricultural buildings.

SUBSTANTIATION: The requirements of Section 547-8(a) are much more restrictive than Section 250-24. It is very easy to overlook these requirements if someone is using Article 250 for grounding requirements. We have been taught to use Article 250 for all grounding, and now we have another set of rules to comply with but no reference to them.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 86 - (250-24(a) and (b), Exception No. 3-(New)):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

Exception No. 3 to (a) and (b): "Where the disconnecting means for the building or structure is located in accordance with Exception No. 1 or Exception No. 2 of Section 230-84 or the Exception to Section 230-205 (a)."

SUBSTANTIATION: The referenced sections permit location of disconnecting means remote from the building or structure served. The conductors from such disconnecting means are normally feeders or branch circuits. With no disconnecting means at the building served the requirements of (a) and (b) for connection of a grounding electrode to the grounded conductor on the supply side of the disconnect or the enclosure of the disconnect does not appear to be a viable means to provide equipotential conditions in the building served.

This section does not appear to address the bonding/grounding to electrodes (if intended) for the exceptions to Sections 230-84 and 230-205.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: McIntosh, Sessler, Skuggevig, Toomer.

EXPLANATION OF VOTE:

MCINTOSH: At the Miami meetings of CMP-5 an Ad Hoc Committee was assigned to give further study to the Proposal and the Committee Action. The Ad Hoc Committee has done this and recommends that the submitter's intent is better served by replacing the proposed (Section 250-24(a) and (b), Exception No. 3-(New)) with a new Section 250-24(c) which follows. Refer also to Panel Action on Proposal No. 05-082 (Log #10).

(c) DISCONNECTING MEANS LOCATED IN SEPARATE BUILDING OR STRUCTURE ON THE SAME PREMISES. Where under single management, the service disconnecting means for the second building or structure on the same premises shall be permitted to be located in a separate building or structure in accordance with Section 230-84(a), Exception Nos. 1 or 2, or Section 230-205(a), Exception, provided all the following conditions are met:

(1) The connection of the grounded circuit conductor to the grounding electrode at the second building or structure shall not be made;

(2) An equipment grounding conductor for grounding any noncurrent-carrying equipment, interior metal piping systems, and building or structural metal frames is run with the circuit conductors to the second building or structure and bonded to existing grounding electrodes described in Part H, or where there are no existing electrodes, a grounding electrode meeting the requirements of Part H shall be installed where the second building or structure supplies more than one branch circuit;

(3) Bonding the equipment grounding conductor to the grounding electrode at the second building or structure shall be made in a junction box located immediately inside or outside the second building or structure.

Exception No. 1: A grounding electrode at the second building or structure shall not be required where only one branch circuit is supplied and there is no equipment in the building or structure that requires grounding.

Exception No. 2: Where livestock is housed, that portion of the equipment grounding conductor run underground to the disconnecting means shall be insulated or covered copper.

SESSLER: The proposal provides no solution to grounding if the disconnect is located in accordance with Exception No. 1 or Section 230-205(a). Grounding rules are needed when this exception is applied.

SKUGGEVIG: I agree with the intent of this proposal, but I suggest that the proposed wording for the new Exception No. 3 for Section 250-24(a) and (b) be revised to more clearly state the rule. Perhaps the following wording will better convey the intent:

Exception No. 3 to (a) and (b): Where the disconnecting means for the building or structure is not located at the building or structure but is located elsewhere in the premises wiring system in accordance with Section 230-84(a) Exception Nos. 1 & 2 or Section 230-205(a) Exception, all of the following conditions shall be met: (1) An equipment grounding conductor shall be run with the circuit conductors to the separate building or structure. (2) The equipment grounding conductor shall be bonded to existing grounding electrodes described in Part H, or where there are no existing electrodes, a grounding electrode meeting the requirements of Part H shall be installed and bonded to the equipment grounding conductor. (3) A connection between the grounded circuit conductor and the grounding electrode shall not be made at the separate building or structure.

TOOMER: This is adequately covered by existing exceptions.

Log # 1395

5- 87 - (250-24(b)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 19 and 20 for information.

SUBMITTER: George B. Wiggin, Lusby, MD

RECOMMENDATION: Revise as follows:

250-24(b): ONE OR MORE BUILDINGS SUPPLIED FROM ANOTHER.

1. Where currents from the grounded conductor seeking an EARTH return back to the originating building service are not objectionable, it shall be permitted to re-ground the incoming grounded conductor to one or more of the grounding electrodes in Part H. If there are no existing grounding electrodes than one shall be provided.

Exception No. 1. An equipment grounding conductor, sized in accordance with 250-95, shall be permitted to run with the branch circuit or feeder conductors supplying the other building. It shall be required to bond all non-current-carrying equipment, interior metal piping systems, building or structural metal frames and any existing electrodes as identified in Part H to this equipment grounding conductor. The grounded supply conductor or circuit conductor shall not be bonded at the structure disconnecting means to the equipment grounding conductor.

Exception No. 2. Where one or more buildings housing livestock are supplied from another building an insulated copper equipment grounding conductor, sized in accordance with Table 250-95, shall be run with the feeder or branch circuit conductors. It shall bond all non-current-carrying equipment, interior piping systems, building or structural metal frames and any existing electrodes as identified in Part H. It shall not be bonded to the grounded supply conductors.

(FPN): GROUND CURRENTS. (those seeking an earth return back to the original service equipment), have proved to be harmful to livestock. The use of an insulated equipment ground eliminates such ground currents except under fault conditions when the equipment grounding conductor is connected to any existing grounding electrodes at the served building.

(FPN): To completely eliminate ground currents (those that originate from other sources) that prove to injurious to livestock an isolation transformer must be used so that there is no interconnection of the grounding paths.

Exception No. 3. Where the supplied building serves a swimming pool with an under-water lighting fixture the supply conductors, (branch circuit or feeder), shall be enclosed in a non-metallic or metallic raceway and an insulated equipment grounding conductor, sized in accordance with Table 250-95, shall be required to run with the circuit conductors and it shall be connected as in Ex #2.

Identify 250-24(b) as 250-24(c).

SUBSTANTIATION: The exceptions to 250-24 as written are confusing and in the case of exception #1 describe a condition that can't exist.

The method of grounding and providing power to mobile homes, grounding and providing shore power to boats, and providing grounding and power to under-water lighting fixtures for swimming pools in accordance with the N.E.C. is the safest possible approach except requiring an isolation transformer. There is no reason to assume or require a totally different grounding method when one or more buildings is provided power from another building and all buildings are under single management.

The addition of a supplementary grounding electrode only serves to reduce the ground resistance of the grounding electrode and does nothing to reduce the interception of ground currents returning to the utility sub-station

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the proposal is contrary to the Panel's intent in Section 250-24(a). The Panel intends that the grounded conductor be regrounded to a grounding electrode system as described in Part H, subject to the existing exceptions.

The proposal does not substantiate the need for restrictive wiring methods for swimming pools and marinas.

The Panel does not agree with the substantiation that the conditions in Exception No. 1 of Section 250-24(a) can exist, for example, in nonmetallic lighting fixtures installed in a tool shed.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 631

5- 88 - (250-24(c) and Exceptions No. 1 and No.

2-(New)): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"(c) Grounding conductor. The size of the grounding conductor to the grounding electrode(s) shall not be less than given in Table 250-95, and the installation shall be in accordance with Section 250-92(a).

Exception No. 1: The grounding conductor shall not be required to be larger than the largest ungrounded supply conductor.

Exception No. 2: Where connected to made electrodes as in Section 250-83(c) or (d) that portion of the grounding conductor which is the sole connection between the electrode(s) and the grounded or grounding conductor or the metal enclosure of the building disconnecting means shall not be required to be larger than No. 6 awg cu. or No. 4 awg al."

SUBSTANTIATION: Sizing and installation requirements are not clear. A grounding conductor between grounding electrodes and grounded conductors appears to be a grounding electrode conductor per Article 100; a grounding conductor for equipment enclosures appears to be an equipment grounding conductor. Since the grounding conductor for this section does not appear to be specifically designated specific requirements are warranted.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MCINTOSH: If Proposal No. 05-086 is accepted by CMP-5 it appears the language of the NEC would be better served to number it Section 250-24(c) and number Proposal No. 05-088 as Section 250-24(d).

Log # 1133

5- 89 - (250-25): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first line in the sentence immediately after Section 250-25(5) as indicated: grounded "(neutral)" conductors shall be identified

SUBSTANTIATION: Same as Proposal 5-1.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1134

5- 90 - (250-25, Exception-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 250-25(5), add as indicated:

"Exception: As permitted in Section 250-5, Exception Nos. 1 through 5 and where elsewhere permitted in this Code."

SUBSTANTIATION: This proposal, if approved, would simplify and clarify the Code meaning and intent and prevent confusion and misapplication which could result in the endangerment of persons and property. For example, in Section 250-5 there are five Exceptions which exempt certain systems/conditions from grounding requirements but in Section 250-25, no such information is provided.

PANEL ACTION: Reject.

PANEL COMMENT: Section 250-5 contains the rules for what systems shall be grounded. Section 250-25 contains the rules for which conductor shall be grounded, given that the system is to be grounded, either because it is required to be grounded or is permitted to be grounded. The exceptions to Section 250-5 do not apply to Section 250-25.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1135

5- 91 - (250-25(1)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Change sentence to read:

(1) Single-phase, 2-wire: (one) "the neutral" conductor.

SUBSTANTIATION: In the interest of consistency and clarity the term "neutral conductor" should be used. For example, in Section 250-(2), the term used for the same conductor is: "neutral conductor" and in Section 250-25(1) the term used for the very same conductor is: "one conductor".

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1. There is no neutral in a 2-wire system.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1136

5- 92 - (250-25(3)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first and second lines in the sentence as indicated:

... systems having one (wire) "neutral conductor" common to all phases: the (common) "neutral" conductor.

SUBSTANTIATION: Since, by definition, this is a "Wye" system the term "neutral conductor" should be used because the term "neutral conductor" conforms more closely with the Code terminology as used in this Code. This change, if approved, would help in minimizing confusion and misapplication which can cause costly errors and endangerment to persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1137

5- 93 - (250-25(5)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first and second lines as indicated:

... systems (in which) "having" one phase (is used as in (2) above:) "with a midpoint circuit conductor:" the (neutral) "grounded" conductor.

SUBSTANTIATION: The idea of referring to a single-phase, 3-wire system (250-25(2)) to define "grounding" in a multiphase delta system may be logical but the potential for confusion and misapplication is ever-present. This recommendation, if approved, would help to simplify and clarify the Code meaning/intent.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1138

5- 94 - (250-26(a), (b) and Exception): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: In 250-26(a), amend the third line in the first sentence, in 250-26(b), amend the third line in the first sentence and in Exception, amend the third line as indicated:

... to the grounded "(neutral)" conductor.
... provided the system grounded "(neutral)" conductor is bonded ...

SUBSTANTIATION: Same as Proposal 5-1.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 690

5- 95 - (250-26(a) and (b), 250-27(c), 250-94, Exception-(New)): Reject
SUBMITTER: Joseph S. Dudor, Midway City, CA
RECOMMENDATION: Add new exception to all of the above sections worded as follows:

Exception: For high impedance grounded neutral systems, see Section 250-27(g).

SUBSTANTIATION: See justification for proposal to add new Section 250-27(g).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-102.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2597

5- 96 - (250-26(a), Exception No. 2-(New)): Accept
SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association
RECOMMENDATION: Change the exception for Section 250-26(a) to exception No. 1.

Add a new exception No. 2 for Section 250-26(a) to read:

"As covered in Section 250-27 and exception No. 5 for Section 250-5(b) for high-impedance grounded neutral systems grounding connection requirements."

SUBSTANTIATION: Reference to Section 250-27 and exception No. 5 of Section 250-5(b) is needed in exception No. 2 for Section 250-26(a) and exception No. 2 for Section 250-26(b), since a high impedance grounded neutral system could be used in a separately derived AC system and Section 250-27(c) precludes solidly grounding by a main bonding jumper.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3152

5- 97 - (250-26(b)): Reject
SUBMITTER: James G. Andrews, McDonnell Douglas Aircraft
RECOMMENDATION: New text:

... "Except as permitted by Exception No. 4 of Section 250-23(a)" and (e) below.

SUBSTANTIATION: Aircraft test stations receive two sources of power (1) 208 volt, 3-phase, 60 Hz (2) 208 volt 3 phase 400 Hz, both are separately derived systems. Grounding must simulate a single ground point, such as an aircraft in flight. Two equipment grounds are required by section 250-57 to be run WITH their circuit conductors. Only one ground path is desired, this would alleviate noise problems and a parallel path to ground. Noise levels must be kept under 200 millivolts which is further complicated by the testing and operating frequencies of the equipment from 100 megahertz to 40 gigahertz.

The inductive reactance at those high operating frequencies limits the grounded conductor in length and size, length estimated from 0 ft to 30 ft maximum and conductor size from 2/0 minimum to 2" tubular copper bus. Inductive reactance at the high operating frequencies is a greater practical concern than inductive coupling and induced currents between jointly run equipment grounding and power circuit conductors. Furthermore, the practical concern of maintaining a low impedance to ground is in line with the intent of

Article 250-57(b). Therefore, requiring this specific equipment ground to be run with the circuit conductors to reduce inductive coupling should not be a primary consideration. By having the grounded conductor of the separately derived systems and the equipment grounding conductors connect to the same point on the grounding electrode (which is bonded to the building ground system) all grounds are the same. Yet a separate path is provided for the test equipment to the same ground point. The two circuit conductors are enclosed in grounded conduit which is bonded to the separate derived systems grounded electrode. Therefore, they are enclosed by the equipment grounding conductor.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-101.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2598

5- 98 - (250-26(b), Exception No. 2-(New)): Accept
SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Change the exception for Section 250-26(b) to exception No. 1.

Add a new exception No. 2 for Section 250-26(b) to read:

"As covered in Section 250-27 and exception No. 5 for Section 250-5(b) for high-impedance grounded neutral systems grounding connection requirements."

SUBSTANTIATION: Same as Proposal 5-9.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3340

5- 99 - (250-26(b), Exception No. 2-(New)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Add a new Exception, as follows:

Exception No. 2: For a separately derived system operating at less than 1000 volts and grounded beyond the source in accordance with Section 250-26(b), the requirements of Section 250-23(b) shall apply between the source and the grounding point.

SUBSTANTIATION: For a separately derived system so grounded, the source-side grounded conductor will constitute a capable ground-fault return path if extended in adequate size as proposed.

PANEL ACTION: Reject.

PANEL COMMENT: The proposer's intent is already covered in Section 250-26(d).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3151

5- 100 - (250-26(c)): Reject

SUBMITTER: James H. Andrews, McDonnell Douglas Aircraft

RECOMMENDATION: New text:

... "electrodes specified by (1) or (2) above are not available" or (4) where other electrodes as specified in 250-81 and 250-83 are effectively bonded to (1) or (2) as required in 250-54.

SUBSTANTIATION: Same as Proposal 5-97.

PANEL ACTION: Reject.

PANEL COMMENT: Substantiation applies to a highly specialized application and does not relate to the proposal which would apply to general rules for grounding.

See Panel Comment on Proposal 5-101.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3150

5- 101 - (250-26(e)-(New)): Reject

SUBMITTER: James G. Andrews, McDonnell Douglas Aircraft

RECOMMENDATION: New text:

3) Where two separately derived alternating current systems supply power to automatic test equipment or electronic systems grouped in a single unit. A grounding electrode conductor connection from each source shall be made to a common grounding electrode. This point shall be located within 20 ft of each separately derived system.

SUBSTANTIATION: Same as Proposal 5-97.

PANEL ACTION: Reject.

PANEL COMMENT: The proposer is addressing a special application. The substantiation is not supportive of a general rule covering all installations. The Panel suggests the submitter resubmit this for action as a special application in Chapters 5, 6, or 7.

The intent of the proposal can be met under the present rules with judicious placement of the separately derived system sources.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 689

5- 102 - (250-27): Reject

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Revise the first sentence of Section 250-27 to read:

"... with the provisions of (a) through (g) below." Add a new paragraph (g) to read:

(g) Size of Main Bonding Jumper, Grounding Electrode Conductor and Neutral Conductor. These conductors shall not be required to be larger than No. 8 AWG copper (no. 6 AWG aluminum) in a high-impedance grounded neutral system. The sizing provisions of Sections 250-23(b), 250-26(a), 250-26(b), and 250-79(c) shall not apply to high-impedance grounded neutral systems.

SUBSTANTIATION: The Panel's comment to Proposal 5-67 in the NEC-TCR-86-A shows an incomplete understanding of the flow of fault currents in a high impedance grounded neutral system, as opposed to an ungrounded system that suffers more than one ground fault. Please refer to the attached diagrams, which show the path of ground fault currents for both types of systems. It is obvious that the ungrounded system will generate high magnitudes of fault currents, thus justifying the same size of grounding and bonding jumpers as required for a solidly grounded system. It is also obvious that the impedance inserted in the connection from the equipment grounding conductors to the system neutral limits the fault current to an extremely low value (< 10 A per ANSI/IEEE 142) under all fault conditions. Since the neutral conductor is only run from the system source to the grounding impedance and is not a branch or feeder circuit conductor, it is highly unlikely that this conductor will become subject to high fault currents. In fact, the only possibility is a phase-neutral fault on the incoming conductors similar to a fault on a service entrance conductor. Since the bonding jumper and grounding electrode conductor play no part in a service entrance cable fault on an ungrounded system, there is no logic in requiring oversized conductors for such conditions. Thus, there is no need to require that bonding, grounding and neutral conductors of high impedance grounded neutral systems be any larger than No. 8 AWG copper or No. 6 AWG aluminum.

NOTE: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Under the condition where a second line-to-ground fault occurs before the first line-to-ground fault is removed, it is likely that large values of current will flow in the grounding electrode conductor. This is due to the fact that there are many parallel metallic paths in most large industrial plants that would increase the flow of current in the grounding electrode conductor, but not in the grounded conductor. The bonding jumper would see the same current as the grounding electrode conductor.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2592

5- 103 - (250-27): Accept in Principle

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Revise Section 250-27 to read:

High impedance Grounded Neutral System Connections. High impedance grounded neutral systems "as permitted in exception No. 5 of Section 250-5(b)" shall comply with the provisions of (a) through (g) below.

SUBSTANTIATION: Exception No. 5 of Section 250-5(b) has a number of limitations on the use of high impedance grounding. Adding a reference in Section 250-27 to exception No. 5 of Section 250-5(b) will ensure that these limitations are not overlooked.
PANEL ACTION: Accept in Principle.

Revise proposal by deleting "(g)" and replace with "(f)."

PANEL COMMENT: There is no paragraph "(g)" since the Panel rejected Proposal 5-104.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2593

5- 104 - (250-27(g)-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add new provision (g) to Section 250-27 "(g) Conductor Sizes. The conductors covered in parts (b), (d), and (e) shall have an ampacity not less than the maximum fault current permitted by the impedance and the phase to neutral voltage but not less than No. 14 AWG copper and No. 12 AWG aluminum.

SUBSTANTIATION: Since the purposes of an impedance grounded system is to limit the ground current to a maximum of the charging current of the system and is determined by the phase to neutral voltage and impedance, the above is appropriate.

If this provision is not listed, the minimum size permitted would be those listed in table 250-94. Manufacturers have reported that resistors used in impedance grounded system will not accept the larger conductors.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-102.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 765

5- 105 - (250-33, Exception No. 2): Reject

SUBMITTER: Rick Sanford, CED

RECOMMENDATION: Delete 250-33 Ext 2.

SUBSTANTIATION: Short sections of metal enclosures such as EMT may lose physical ground when damaged and should not used.

PANEL ACTION: Reject.

PANEL COMMENT: No technical substantiation that such short sections of metal enclosures lose their grounding continuity, since they are not grounded to begin with.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2993

5- 106 - (250-33, Exception No. 3-(New)): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Add a third exception as follows:

Exception No. 3: Enclosures not required to be grounded by Section 250-43(i) shall be permitted to be ungrounded.

SUBSTANTIATION: These two sections should be correlated. It is absurd, and never enforced, to require equipment grounding of a metal box used to enclose splices for a doorbell circuit; for example, and not the doorbell escutcheon itself.

PANEL ACTION: Reject.

PANEL COMMENT: This is adequately covered in Section 250-43(i), and therefore in a Class 2 type circuit of less than 50 volts, the doorbell escutcheon is not required to be grounded.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2300

5- 107 - (250-33(b)-(New)): Reject

SUBMITTER: Nicholas L. Malouf, Holly, MI

RECOMMENDATION: New text:

(b) Nonmetallic Enclosures. Nonmetallic enclosures containing electrical equipment with noncurrent carrying metal parts likely to become energized shall be grounded.

SUBSTANTIATION: The possibility of metal parts becoming energized that is not grounded in a nonmetallic

enclosure is a hazard to persons coming in contact with such metal.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation that a hazard exists.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1464

5- 108 - (250-42(e), Exception-(New)): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal with reference to location of the exception. This action will be considered by the Panel as a Public Comment.

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add a new Exception to 250-42(e) as follows:

Exception: Switch yokes where installed in non-metallic boxes.

SUBSTANTIATION: To clarify an often asked question "DO switch yokes installed in non-metallic boxes have to be grounded?" Since there is generally no method on most switches to accomplish this, the answer usually is "no" since they are not likely to become energized." The possible solution would be to (1) require grounding, (2) require non-metallic yokes, or (3) exempt them from grounding for the reason stated above. Since there is a lack of evidence that there is a problem, solution 3 appears to be the correct answer.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1912

5- 109 - (250-42(f)): Reject

SUBMITTER: Raymond P. Pelletier, City of Auburn, ME

RECOMMENDATION: Revise as follows:

Circuits exceeding 120 volts nominal between conductors.

SUBSTANTIATION: To clarify the requirement and more accurately reflect the intent.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the limitation of 150 volts to ground should be maintained to allow for such systems as 120/208 volt, 3-phase. The substantiation does not show a need for the proposed change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1647

5- 110 - (250-42(f), Exception No. 4): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal with reference to location of the exception. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Paul Duks, Underwriters Laboratories Inc.

RECOMMENDATION: In first line delete "information processing and listed office" to read:

Exception No. 4: Listed equipment protected by a system of double insulation, or its equivalent, shall not be required to be grounded. Where such a system is employed, the equipment shall be distinctively marked.

SUBSTANTIATION: Double-insulation should be permitted in lieu of grounding for various types of equipment operating over 150 volts to ground, without restricting the permission to only information processing and office equipment because: (1) double insulation is equivalent to grounding, (2) the effectiveness of the system is unrelated to voltage, and (3) the effectiveness of the system is unrelated to the function of the equipment. Furthermore, the system is independent of field connections. Also Sections 250-45(c) and 250-45(d) permit Listed cord- and plug-connected equipment operating under 150 volts to ground to be double-insulated in lieu of being grounded without restriction as to specific function. There is considerable experience in Europe with double insulation on various types of equipment, most of it over 150v to ground.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 111 - (250-43(d), Exception No. 2-(New)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 11 for information.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception No. 2: Enclosures attached to ungrounded portable equipment."

SUBSTANTIATION: To conform to Exception No. 1 of Section 430-144. In the 1987 TCR the panel stated it is desirable to maintain Exception No. 1 in this section in lieu of a reference to Section 430-144. For consistency Exception No. 1 of Section 430-144 should also be in this section.

PANEL ACTION: Accept in Principle.

Identify the proposal as "Exception No. 1" and renumber the existing Exception as "Exception No. 2."

PANEL COMMENT: To correlate with Section 430-144, Exceptions.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 112 - (250-43(f)): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Electric utilization equipment in commercial repair garages, theaters, and motion picture studios."

SUBSTANTIATION: "Equipment" per definition includes apparatus which may be exempted from grounding by subsection (i). The present wording includes residential garages where equipment fastened in place (even though cord-connected) may be exempted from grounding by Sections 250-42(a), 250-33 Exception No. 1, and 250-45(c).

PANEL ACTION: Accept in Principle.

Revise the present code Section 250-43(f) by adding the word "commercial" between "in" and "garages."

PANEL COMMENT: Panel agrees that residential garages are not covered by this section.

Panel does not agree to the inclusion of item "utilization" since devices would not be covered by this section.

Commercial garages would cover both repair and storage.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 113 - (250-43(g), Exception): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 18 for information.

SUBMITTER: H. Lester Browne, Salem, OR

RECOMMENDATION: Delete Exception

SUBSTANTIATION: At least two deaths in Oregon in the past year have resulted from shock induced from faulty electrical signs that were in compliance with this Exception; one in Roseburg, Oregon in which I investigated. The 120V. fluorescent ballast had faulted on an insulated sign. When the electrician touched it from his ladder truck, he received a fatal shock of approximately 450 volts. The prevalent use of ladder trucks for maintenance of signs creates a hazard when these signs are ungrounded. I am, on a separate sheet, requesting that Article 600-5 Exception #1 be deleted also.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

SESSLER: The Panel action should be sent to Panel 18 for information and correlation.

5- 114 - (250-43(i)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"Equipment supplied by Class 1, Class 2, or Class 3 remote control, signaling, or power circuits where a circuit conductor is grounded or where the equipment is located in a hazardous (classified) location."

SUBSTANTIATION: Where such circuits are grounded by choice and not because mandated by Code in Part B the same valid reasons exist to require equipment grounding. The reference to hazardous (classified) locations would correlate with Section 250-42(d).

PANEL ACTION: Reject.

PANEL COMMENT: There is no support to require nonhazardous location equipment supplied by nonhazardous location circuits to be grounded if circuit is grounded by choice.

Grounding of equipment in hazardous locations is covered by Section 250-42(d).

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 115 - (250-43(i)): Accept

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Revise to read as follows:

(i) Remote-Control, Signaling, and Fire Protective Signaling Circuits. Equipment supplied by Class 1, Class 2, and Class 3 remote-control and signaling circuits, and by fire protective signaling circuits, shall be grounded where system grounding is required by Part B of this article.

SUBSTANTIATION: This revision is intended to correlate with Section 760-6 as well as a companion proposal by the submitter to Section 250-33. A minor change has been suggested to explicitly mention system grounding for clarity.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 116 - (250-43(k)-(New)): Accept

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: Add a new paragraph (k) to read:

"Motor-Operated Water Pumps. Motor-operated water pumps including the submersible type."

SUBSTANTIATION: Although Section 250-43(c) covers grounding of motor frames, Section 430-142 is not clear regarding if submersible water pumps such as for water wells are required to be grounded. Submersible pump manufacturers argue that submersible pump motors in driven wells with groundwater inaccessible to direct contact do not require grounding. Section 430-142 requiring the frames of motors which are not grounded to be permanently and effectively insulated from ground. This appears impossible for a submersible pump. Grounding of submersible pumps will reduce stray voltages which cause serious problems on dairy farms. This proposal will clarify that these pumps are required to be grounded. The Canadian Electrical Code (copy attached) requires grounding of submersible pumps.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 117 - (250-45(b)): Reject

SUBMITTER: Raymond P. Pelletier, City of Auburn, ME

RECOMMENDATION: Revise as follows:

Circuits exceeding 120 volts nominal between conductors

SUBSTANTIATION: To clarify the requirement and more accurately reflect the intent

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-111.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1646

5- 118 - (250-45(b), Exception No. 3): Accept
SUBMITTER: Paul Duks, Underwriters Laboratories Inc.
RECOMMENDATION: In first line delete "information processing and listed office" to read:

Exception No. 3: Listed equipment protected by a system of double insulation, or its equivalent, shall not be required to be grounded. Where such a system is employed, the equipment shall be distinctively marked.
SUBSTANTIATION: Double-insulation should be permitted in lieu of grounding for various types of equipment operating over 150 volts to ground, without restricting the permission to only information processing and office equipment because: (1) double insulation is equivalent to grounding, (2) the effectiveness of the system is unrelated to voltage, and (3) the effectiveness of the system is unrelated to the function of the equipment. Furthermore, the system is independent of field connections. Also Sections 250-45(c) and 250-45(d) permit Listed cord- and plug-connected equipment operating under 150 volts to ground to be double-insulated in lieu of being grounded without restriction as to specific function. There is considerable experience in Europe with double insulation on various types of equipment, most of it over 150v to ground.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 54

5- 119 - (250-45(c), Exception No. 2-(New)): Accept
SUBMITTER: Thomas D. Wilhelm, City of University Heights, OH

RECOMMENDATION: Renumber existing Exception as Exception No. 1 and add a new Exception No. 2 to read as follows,

Utilization equipment connected to a Ground Fault Circuit Interrupter type of outlet installed in accordance with 210-7(d) Exception.
SUBSTANTIATION: Clarification. Currently this Section of the Code conflicts with Section 210-7(d) Exception in so far as utilization equipment itemized in 250-45(c) is required to be grounded but 210-7(d) Exception does not require grounding of Ground Fault Circuit Interrupter type outlets installed in existing locations without any restrictions on the type of utilization equipment being supplied. This comes up quite often in renovating residential occupancies where appliances requiring grounding per 250-45(c) are already located in an area. By recognizing this alternate method excessive additional expense will be avoided while still allowing an equivalent measure of safety.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 635

5- 120 - (250-45(d)(6) and Exception No. 1): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "wet and conductive" to "wet or conductive".

SUBSTANTIATION: Both conditions should not be required for mandatory grounding or exceptions.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1208

5- 121 - (250-46): Reject

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: Last phrase of article (250-46):

"or they shall be bonded to the lightning rod conductors" should be deleted.

SUBSTANTIATION: Bonding causes more risk than benefit. It is preferable to choose a better way for the lightning rod conductor.

PANEL ACTION: Reject.

PANEL COMMENT: There is no technical support provided. This requirement is covered by NFPA 78.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2407

5- 122 - (250-46, FPN): Accept

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Revise first sentence to include quoted area:

(FPN): See Sections 250-86 and 800-31(b)(5)"c(3)."
SUBSTANTIATION: Reference to Section 800-31(b)(5) should be more specific.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 95

5- 123 - (250-50): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Between the first and second sentences add:

"Where isolated equipment grounding conductors are installed, they shall be connected in accordance with Section 250-74, Exception No. 4."

SUBSTANTIATION: Since this section covers the connection of equipment grounding conductors, a reference to isolated equipment grounding conductors should be added because the installation of computer systems with isolated equipment grounding conductors is at an all-time high and there are many who are not familiar with the requirements for isolated equipment grounding conductors all/partly because the applicable Code reference (Exception No. 4) is "hidden" in a section (250-74) titled: "Connecting Receptacle Grounding Terminal to Box."

PANEL ACTION: Reject.

PANEL COMMENT: There is no evidence or experience to show a need for a change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1510

5- 124 - (250-50(b), Exception): Reject

SUBMITTER: David E. Shapiro, Safety First Electrical Contracting, Consulting & Safety Education

RECOMMENDATION: Delete entire exception

SUBSTANTIATION: With the increased use of non-metallic plumbing pipe, both for waste and for supply (especially with the new 95/5 solder requirement), there is an unacceptably great danger of disruption of the ground path as old plumbing is replaced piecemeal, just as the old electrical system is being upgraded piecemeal. There is no way in blazes a plumber can know, in many cases, that the metallic plumbing pipe UPSTREAM of the rotten piece he is cutting out has a circuit bonded to it for grounding. You cannot expect plumbers to automatically bond around any plastic they put in, just in case. Customers are far better off paying a few more dollars for the electrician to run that separate grounding conductor to the nearest grounded part of the ELECTRICAL system. No inspector will fault that solution.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter offers no suitable alternative for grounding receptacles under these circumstances.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 96

5- 125 - (250-51): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in the first sentence in Section 250-51 as indicated:

... equipment, and (conductor enclosures) "and metal enclosures for conductors" shall ...

SUBSTANTIATION: "Metal" enclosures should be indicated to conform the phraseology used in the Code.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1658

5- 126 - (250-51 and FPN-(New)): Reject

SUBMITTER: Duane McNamee, City of Phoenix, AZ

RECOMMENDATION: Revise as follows:

The path to ground from circuits, equipment, and conductor enclosures shall: (1) be permanent and continuous; (2) (have capacity to conduct safely any fault current likely to be imposed on it) "have a withstand rating to conduct safely any fault current likely to be imposed on it;" and (3) have sufficiently low impedance to limit the voltage to ground and to facilitate the operation of the circuit protective devices in the circuit.

The earth shall not be used as the sole equipment grounding conductor.

(FPN): The available fault current, the thermal rating of insulation and/or material used and the overcurrent device opening time must be considered.

Note: Added material in quotations, deleted material in parenthesis.

SUBSTANTIATION: The City of Phoenix Electrical Plan Review Department has available for IBM PC's a program for conductor withstand. Formula from IPCEA (ICEA) Standard P32-382.

Local utilities are dictating available fault currents as high as 154,000 at 480Y/277-304W systems.

Present NEC grounding and/or bonding conductor sizes are stated as a minimum size. See heading above Table 250-95. HELP

See preliminary copy of thesis on withstand.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Changes proposed are design consideration and should not replace Code requirements. Not all equipment in the effective grounding path has a withstand rating, for example raceways.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2427

5- 127 - (250-51(a)-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 8 for action. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Michael L. Mills, Newbury Park, CA

RECOMMENDATION: New text:

(a) Conduits buried or in contact with earth shall not be considered an effective grounding path.

Exception: Temporary metallic conduits whose expected life time & soil corrosiveness are acceptable to authority having jurisdiction.

SUBSTANTIATION: Our company has unearthed metallic service power conduits acceptable in 1964 for burial that were severely corroded & literally falling apart - undeniably not an acceptable ground path (when unearthed, water came pouring out of corrosion, openings). Many jurisdictions don't enforce proper conduit types for underground conduits or are arbitrary with the end result that conduit impedance ground return eventually becomes so high (over years) that the earth becomes major grounding conductor in violation of 250-51. Soil corrosiveness can be so unpredictable and variable even within one jurisdiction or change (one year dry - next year continuously wet) over time that conduit impedance can become so high, even infinite. This effect is observed to be most pronounced at the thread couplings where structural & electrical integrity is the poorest & corrosion is the greatest. This code addition would eliminate arbitrary allowance of underground (metallic) conduits as a ground return path & require ground bonds with the conduits - which is the only way underground raceways should be wired!

PANEL ACTION: Reject.

PANEL COMMENT: Soil surveys and service by a competent corrosion control engineer before beginning a new installation and at periodic intervals throughout the life of the underground facilities are important in the mitigation of the underground corrosion problem. This goes beyond the scope of the NEC.

In addition, the Correlating Committee has assigned the responsibility of this subject to CMP 8 and it is recommended that this proposal be referred to CMP 8 for action.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: It has been proven many times that metallic conduits that are buried or in contact with earth will corrode and the earth becomes the grounding conductor in violation of this Article as now written.

Log # 2594

5- 128 - (250-53(a), Exception-(New) and (b), Exception-(New)): Accept in Principle

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add a new exception to 250-53(a) after FPN to read:

"As covered in Section 250-27 for high impedance grounded neutral system connections."

Add a new exception No. 1 to 250-53(b) to read:

"As covered in Section 250-27 for high impedance grounded neutral system connections."

SUBSTANTIATION: The exception for Section 250-53(a) and the exception No. 1 for Section 250-53(b) are needed to cover high impedance grounded systems covered in Section 250-27.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Place the new exception before the fine print note in accordance with NFPA Manual of Style.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 636

5- 129 - (250-53(b)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise as follows:

"... within the service disconnect enclosure, or where two to six service disconnect means are installed, the main bonding jumper shall be permitted within the service conductor enclosures."

SUBSTANTIATION: Section 384-3(c) requires the main bonding jumper within the service disconnect enclosures. The proposal would provide correlation and limit the location.

PANEL ACTION: Reject.

PANEL COMMENT: It is the intent to require the main bonding jumper to be located within the service disconnect enclosure. See Panel Action and Comment on Proposal 5-67.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2599

5- 130 - (250-53(b), Exception-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add a new exception No. 2 to Section 250-53(b) to read:

"If a multi-section switchboard serves as the service equipment, the main bonding jumper shall be permitted to be located in any section of the same switchboard provided: (1) the main bonding jumper is located on the supply side of the grounded conductor disconnecting means; and (2) the section containing it is clearly marked to show that the main bonding jumper is located within that section."

SUBSTANTIATION: The new exception No. 2 for Section 250-53(b) is intended to clarify that in a multi-section switchboard the grounding electrode conductor connector and bonding jumper may be located in a section other than the main section.

The ANSI Standard for Dead Front Switchboards UL 891 and the Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear UL 1558 allow the grounding electrode conductor connector to be in a section other than the main section if the sections are manufactured as a group to constitute a single switchboard. Each section of such a group is identified with a section number showing its intended location when assembled at the site.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-64.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2368

5- 131 - (250-57(b), Exception No. 1): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Revised text:

Exception #1. An insulated or covered conductor larger than "No. 10" shall at the time of installation be permitted to be permanently identified as a grounding conductor at each end and at every point where the conductor is accessible, identification shall be accomplished by one of the following means - a.b.c. (same).

SUBSTANTIATION: Many times #6 and #8 wire are not available in green or green with a yellow stripe. However, the contractor cannot re-identify a conductor green or cannot use a bare #6 or #8 when smaller than #4 wire. This would help alleviate some of the lawsuits, since it is common practice to re-identify or strip bare the exposed wire on sizes #6 and #8 wire.

PANEL ACTION: Reject.

PANEL COMMENT: It is the intent that these sizes be available and the Panel believes they are. No substantiation to support the change. A bare conductor is generally acceptable.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 637

5- 132 - (250-57(b), Exception No. 3): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert "No. 6 awg or smaller" between "conductor" and "in".

SUBSTANTIATION: Since Exception No. 1 of (b) permits the same identification as Exception No. 3 for No. 4 or larger conductors without regard to conditions of maintenance and supervision it should be applicable whether or not the conductor is part of a multiconductor cable. It appears more reasonable to apply the restrictions of maintenance and supervision to multiconductor cables of smaller conductors.

PANEL ACTION: Reject.

PANEL COMMENT: This proposal does not add anything to the Code since Exception No. 3 covers any size multiconductor cable under the conditions stated.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2350

5- 133 - (250-59(b), Exception No. 2-(New)): Reject

SUBMITTER: Frank Martucci, Fort Lee, NJ

RECOMMENDATION: New text:

Exception #2: Redundant grounding by means of 2 equipment grounding conductors run with the power supply conductors in a flexible cord properly terminated in a grounding-type attachment plug with one or two fixed grounding contacts, shall be permitted.

SUBSTANTIATION: Same as Proposal 5-230.

PANEL ACTION: Reject.

PANEL COMMENT: The redundant grounding is presently permitted by the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3149

5- 134 - (250-57(b), Exception No. 4-(New)): Reject

SUBMITTER: James G. Andrews, McDonnell Douglas Aircraft

RECOMMENDATION: New text:

Exception 4. Where two separately derived alternating current systems supply power to automatic test equipment or electronic systems grouped as a single unit, a single grounding conductor of 2/0 minimum size shall be permitted to run separate of both circuit conductors for a distance not to exceed 30 ft to the grounding electrode as specified in 250-26e.

SUBSTANTIATION: Same as Proposal 5-97.

PANEL ACTION: Reject.

PANEL COMMENT: The proposer is addressing a special application. Support has not shown the safety of such an installation under fault conditions or ability to meet the intent of Sections 250-51 and 110-10.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2370

5- 135 - (250-60): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Delete the words (or junction boxes) from the third line of paragraph 250-60.

SUBSTANTIATION: The problem with bonding the neutral of the system to the junction boxes is anytime there is a high resistance connection, or an open in the neutral at the sub panel, main, or meter, or even before, the metal raceway system connected to that box, when the box is mounted to a metal studs system which is in turn energized by this neutral and all metal piping to kitchen luminous ceiling and metal bath tubs up against metal studs then become part of this circuit. Even the metal raceway system fasten to the sub panel will energize the bonding system of the entire house.

PANEL ACTION: Reject.

PANEL COMMENT: The junction boxes are an integral part of the electric system and therefore, should be grounded. If the junction boxes were left ungrounded and a fault occurred in the junction box, the hazardous conditions could be worse in the proposed substantiation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1027

5- 136 - (250-60(c)): Reject

SUBMITTER: David Shapiro, Safety First Electrical Contracting

RECOMMENDATION: 250-60(c) (CHANGE) "service equipment." to "service equipment or at a panelboard directly associated with the service equipment in accordance with section 230-63(a)."

SUBSTANTIATION: I had proposed that oversized wiring devices be marked with their volume, and box fill be calculated in accordance with their marked volume, rather than with the volume required for one conductor. This would have required changes in section 370-6 and elsewhere. This was not adopted, but I would be interested in seeing a record of its discussion. I did not find it in a cursory glance through the two published volumes.

For the 1990 NEC I would like to propose that "floating neutrals" not be required in subpanels directly associated with service equipment and connected so as to constructively form part of the equipment. Insasmuch as in that circumstance there is no substantive increase in danger of imposing a voltage on grounded equipment, I can see no argument against this simplification of installations.

The above changes would accomplish this purpose.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation to justify this change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2336

5- 137 - (250-60(c)): Reject

SUBMITTER: James T. Dollard, Jr., Philadelphia, PA
RECOMMENDATION: Revised text:

(c) The grounded conductor is insulated; or the grounded conductor is uninsulated and part of a type SE, UF, NM or NMC Cable and the branch circuit originates at the service equipment.

SUBSTANTIATION: This proposal suggests that cable types UF, NM and NMC be approved for use as outlined in 250-60C, TYPE SE cable is now approved for this use. AFT. 338-1 states SE cable has a flame retardant, moisture, resistant covering. Cable TYPES UF, NM & NMC equal this covering (see 339-1a and 336-1). I feel that these cable types should be approved along with SE. This would allow the installer to choose according to cost, availability and the particular installation. (See proposals to ART 339-1a and 336-25).

PANEL ACTION: Reject.

PANEL COMMENT: Panel does not believe that the rule should be expanded to permit equipment grounding conductors to serve as the grounded conductor.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 794

5- 138 - (250-60(d)): Reject

SUBMITTER: Joe Tedesco, Weymouth, MA

RECOMMENDATION: Delete.

SUBSTANTIATION: Ranges are not permitted to contain receptacles under present testing standards.

PANEL ACTION: Reject.

PANEL COMMENT: Submitter has not shown that receptacles are not permitted on all the appliances covered by this section.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3341

5- 139 - (250-61(a)): Accept in Principle

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Revise to read as follows:

(a) Supply-side Equipment. A grounded circuit conductor shall be permitted to ground noncurrent-carrying metal parts of equipment, raceways, and other enclosures under the following conditions:

(1) On the supply side of the service disconnecting means.

(2) On the supply side of the main disconnecting means for separate buildings as provided in Section 250-24.

(3) On the supply side of the point of connection to the grounding electrode conductor in a separately derived system.

SUBSTANTIATION: There is no distinction between the conditions obtaining in a separately derived system from those obtaining in a service, insofar as flow of ground-fault current and relative potential between grounded conductor and metal enclosure are concerned, on the supply side of the grounding point. Further, 250-61(b), in prohibiting use of the grounded circuit conductor for equipment grounding in a separately derived system beyond the grounding point, implies acceptability of such use ahead of the grounding point. This implication should be made specific.

PANEL ACTION: Accept in Principle.

Revise the proposal as follows:

In paragraph (a), delete "under the following conditions" and replace with "at any of the following locations."

In paragraph (3), revise it as follows:

"(3) On the supply side of the disconnecting means or overcurrent devices of a separately derived system."

PANEL COMMENT: The Panel believes that the revision meets submitter's intent and notes that his intent would not be achieved if the grounding electrode conductor was placed at the source.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1139

5- 140 - (250-61(a), (b) and Exception No. 3): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first lines in the first sentences in Sections 250-61(a), 250-61(b) and line 2 in Exception No. 3 as indicated:

... grounded "(neutral)" conductor shall be ...
... grounded "(neutral)" conductor shall not ...
... connection to the grounded "(neutral)" circuit conductor ...

SUBSTANTIATION: Same as Proposal 5-1.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2361

5- 141 - (250-61(b), Exception No. 3): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

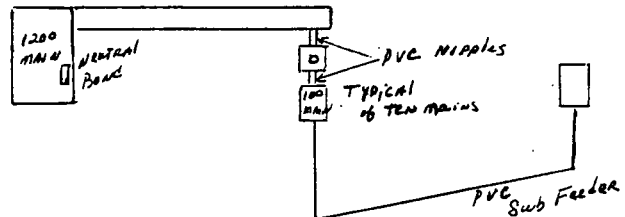
RECOMMENDATION: Revised text:

It shall be permissible to ground meter enclosures and sub mains by connection to the grounded service conductor on the load side of the service disconnect if:

a. No service ground fault protection is installed; and

b. All meter enclosures and "sub mains" are located near the service disconnecting means.

SUBSTANTIATION:



When PVC nipples are used, it is necessary to run back thru the meter with an equipment ground to the gutter to bond the 100A main disconnect.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation to support the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1190

5- 142 - (250-61(b), Exception No. 3b): Reject

SUBMITTER: Earl G. Legacy, Public Service Company of NH

RECOMMENDATION: Revise as follows:

b. All meter enclosures are located (near) "within 30 feet and in sight of" the service disconnecting means.

Note: Added material in quotations, deleted material in parenthesis.

SUBSTANTIATION: The word "near" is very ambiguous and interpretations by electrical inspectors and others applying the Code vary widely. "Within 30 feet and in sight of" would define the limits and remove the ambiguity.

PANEL ACTION: Reject.

PANEL COMMENT: There is no substantiation to indicate that the term "near" is causing problems in the field, and as presently written allows some flexibility.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3155

5- 143 - (250-61(b), Exception No. 3b): Reject
SUBMITTER: Richard J. Carnaroli, Electric Council of New England

RECOMMENDATION: "Add; Delete []

b. All meter enclosures are located [near] "within 30 feet and in sight of" the service disconnecting means.

SUBSTANTIATION: The word "near" is very ambiguous and interpretations by electrical inspectors and others applying the Code vary widely. "Within 30 feet and in sight of" would define the limits and remove the ambiguity.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-142.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2600

5- 144 - (250-61(b), FPN-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Add F.P.N. after exception no. 4.

The main bonding jumper, as permitted in exception no. 2 of 250-53(b), is not considered to be on the load-side of the service disconnecting means.

SUBSTANTIATION: A companion proposal has been submitted to add exception no. 2 to paragraph 250-53(b).

This F.P.N. will serve to point out that, even though the bonding jumper may be in a downstream compartment, it is electrically upstream of the service disconnecting means.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action on Proposal 5-64. The exception was rejected.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 145 - (250-61(b), Exception No. 5): Accept

SUBMITTER: CMP 5

RECOMMENDATION: Add a new Exception No. 5 as follows:

"Exception No. 5: DC systems shall be permitted to be grounded on the load side of the disconnecting means or overcurrent device in accordance with Section 250-22, Exception."

SUBSTANTIATION: To correlate with CMP 5 Proposal 5-62 proposal.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1049

5- 146 - (250-71(b)): Accept in Principle
SUBMITTER: Larry W. Grovenstein, General Telephone Company of the South

RECOMMENDATION: Delete the two opening words "At dwellings" so that the section reads

"An accessible means . . .".

SUBSTANTIATION: The accessibility for intersystem bonding is needed at all services. Small business buildings and multi-unit commercial buildings should not be exempted from this requirement. General Telephone of the South sometimes must have an electrician provide access to an existing location in order to have a safe communication system installation. This is an unnecessary expense.

PANEL ACTION: Accept in Principle.

Revise the proposal by also deleting the words "of the dwelling" in the first fine print note.

PANEL COMMENT: To correlate with Panel Action.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: This proposal put an added burden on the electrical contractor and an unnecessary expense on the owner since it will not be known at the time of the installation the bonding needed for the systems that may be added in the future.

Log # 1899

5- 147 - (250-71(b)): Accept in Principle

SUBMITTER: Larry W. Grovenstein, ECSA-PEG

RECOMMENDATION: Delete the two opening words "At dwellings" so that the section reads

"An accessible means . . .".

SUBSTANTIATION: As the use of plastic conduit becomes more common in the electrical construction industry, we are seeing it used in buildings which are not dwellings. This is particularly true in buildings used by small businesses, such as Realtor offices, office condominiums, and small restaurants. These buildings may use frame construction, not unlike that used in dwellings. They are often built on a slab and surrounded by pavement. The power entrance is usually buried, with the transformer located well away from the building, often near the property line. Construction is typically completed and the contractor gone before a future occupant requests communications or CATV service.

In many of these buildings, the service conduit is all plastic and mounted on the outside of the building and the surrounding area is paved. The ground electrode is below the pavement or slab and the grounding electrode conductor is enclosed in the plastic conduit. Thus, the grounding system is not accessible to the communications or CATV installer.

At some locations, the service equipment is flush mounted indoors, and since there is no structural steel, metallic water pipe, or other approved ground electrode items used in the building (250-81), there is just no "ACCESSIBLE POINT" for bonding.

An "ACCESSIBLE POINT" is a necessity at ALL service entrances, not just at residences as the NEC suggests. This is not for the convenience of the communications and CATV installer, but is a must for safety of personnel and property. Inaccessible ground electrode systems are becoming more prevalent with the electrical equipment commonly used today.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Comment on Proposal 5-146.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: Same as Proposal 5-146.

Log # 2165

5- 148 - (250-71(b)): Accept in Part

SUBMITTER: Ralph P. Cochrane, N.C. State Building Code Council

RECOMMENDATION: Delete the words "At dwellings," and add text to then read:

(b) BONDING TO OTHER SYSTEMS. An accessible means external to enclosures, for connecting inter-system bonding and grounding conductors, shall be provided adjacent to the power service entrance or adjacent to the connection of the service grounding conductor to the grounding electrode, by at least one of the following means:

SUBSTANTIATION: Telecommunications and CATV installers frequently encounter buildings, other than dwellings, at which there is no accessible means for bonding the telephone of CATV grounding conductors and the power neutral. Multi-unit office building pose the same bonding and grounding problems as dwellings.

The existing wording permits the accessible means to be near the breaker panel, which may be placed deep within a building, thus making it impossible to place a telephone protector in accordance with 800-2 and also make the grounding conductor short, as suggested in 800-2 FPN. It is a well known fact that the shorter the bonding conductor, the lower the potential difference between services and thus the safer the installation. We believe that there is an inconsistency between the 250-71(b), 800-2(a), and 820-7.

PANEL ACTION: Accept in Part.

The Panel accepts deleting the words "at dwellings."

PANEL COMMENT: The Panel believes the submitter's intent is covered by present text.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: Same as Proposal 5-146.

Log # 2166

5- 149 - (250-71(b)): Accept in Part

SUBMITTER: Ralph P. Cochrane, N.C. State Building Code Council

RECOMMENDATION: Delete the words "At dwellings," Will then read:

(b) BONDING TO OTHER SYSTEMS. An accessible means external to enclosures, for connecting inter-system bonding and grounding conductors, shall be provided at the power service or at a suitable accessible point on the service grounding conductor by at least one of the following means:

SUBSTANTIATION: Telecommunications and CATV installers frequently encounter new multitenant type office buildings, in some cases referred to as "office condos," at which there is no accessible means for bonding the telephone or CATV grounding conductors and the power neutral.

These buildings are not unlike dwellings in construction, and therefore pose the same bonding and grounding problems as dwellings. It is not unusual for the meters for all units in a building to be located on a rack, some distance from the building, with separate power cables run to a service panel located inside each unit.

PANEL ACTION: Accept in Part.

The Panel accepts deleting the words "at dwellings."

PANEL COMMENT: The Panel believes the submitter's intent is covered by present text.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: Same as Proposal 5-146.

Log # 2812

5- 150 - (250-71(b)): Accept in Part

SUBMITTER: Edward H. Marrow, Jr., Telecommunications Transmission & Protection Consultancy

RECOMMENDATION: Delete the words "At dwellings,;" Will then read:

(b) BONDING TO OTHER SYSTEMS. An accessible means external to enclosures, for connecting inter-system bonding and grounding conductors, shall be provided at the service by at least one of the following means:

SUBSTANTIATION: Telecommunications and CATV installers frequently encounter new multi-tenant type office buildings, in some cases referred to as "office condos", at which there is no accessible means for bonding the telephone or CATV grounding conductors and the power neutral.

These buildings are not unlike dwellings in construction, and therefore pose the same bonding and grounding problems as dwellings. It is not unusual for the meters for all units in a building to be located on a rack, some distance from the building, with separate power cables run to a service panel located inside each unit.

PANEL ACTION: Accept in Part.

Panel accepts deleting "at dwellings."

PANEL COMMENT: See Panel Comment and Action on Proposal 5-148.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: Same as Proposal 5-146.

Log # 2813

5- 151 - (250-71(b)): Accept in Part

SUBMITTER: Edward H. Marrow, Jr., Telecommunications Transmission & Protection Consultancy

RECOMMENDATION: Delete the words "At dwellings," and add text to then read:

(b) BONDING TO OTHER SYSTEMS. An accessible means external to enclosures, for connecting inter-system bonding and grounding conductors, shall be provided adjacent to the service entrance by at least one of the following means:

SUBSTANTIATION: Telecommunications and CATV installers frequently encounter buildings, other than dwellings, at which there is no accessible means for bonding the telephone of CATV grounding conductors and the power neutral. Multi-unit office buildings pose the same bonding and grounding problems as dwellings.

The existing wording permits the accessible means to be near the breaker panel, which may be placed deep within a building, thus making it impossible to place a telephone protector in accordance with 800-2 and also make the grounding conductor short, as suggested in 800-2 FPN. It is a well known fact that the shorter the bonding conductor, the lower the potential difference between services and thus the safer the installation. I believe that there is an inconsistency between the 250-71(b), 800-2(a), and 820-7.

PANEL ACTION: Accept in Part.

Panel accepts deleting "at dwellings."

PANEL COMMENT: See Panel Comment and Action on Proposal 5-148.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: Same as Proposal 5-146.

Log # 2865

5- 152 - (250-71(b)): Reject

SUBMITTER: Robert A. Saunders, Sammons Communications

RECOMMENDATION: Revise to read:

"At dwellings, meter enclosures will provide an external lug for bonding antenna systems grounding conductors and an accessible means external to enclosures for connecting intersystem bonding and grounding conductors shall be provided at the service by at least one of the following means:"

SUBSTANTIATION: In the interest of safety, assurance is needed that the antenna system is bonded properly to eliminate differences in potential at TV tuners etc. 820-22(f)(3) requires an individual electrode if no other grounding means is available, however, 820-22(h) requires separate electrodes to be bonded. This provides an impossible task for the antenna system installer. Often, original available external ground attachments get covered-up before the antenna system is installed.

PANEL ACTION: Reject.

PANEL COMMENT: Present requirement does not prohibit meter enclosure connection by suitable means, but the Panel does not want to restrict the location to only meter enclosures.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2468

5- 153 - (250-72): Reject

SUBMITTER: Dave Zaideman, Grand Rapids, MI

RECOMMENDATION: Revised text:

250-72 Method of Bonding Service Equipment. Electrical continuity at service equipment shall be assured by one of the methods specified in (a) through (e) below "and checked with proper meter or continuity checker."

New wording in quotations.

SUBSTANTIATION: The above proposal is to prove that there is electrical continuity at coupling points where conduit is connected to (as in a through e of 250-72) metal enclosures of service equipment.

PANEL ACTION: Reject.

PANEL COMMENT: Testing details are beyond the scope of this Code and the proposal is unenforceable.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2764

5- 154 - (250-72(c), FPN-(New)): Reject

SUBMITTER: Douglas Sartwell, Concord, NH

RECOMMENDATION: Add a new F.P.N. following part (c) of 250-72 worded as follows:

(FPN): Part (c) will assure electrical continuity between connector and raceway (or coupling and raceway) not between connector and service equipment.

SUBSTANTIATION: Part (c) is very often misinterpreted as to allow a threadless connector to bond a raceway to a service enclosure.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the proposal is contrary to the requirements in this section.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2679

5- 155 - (250-72(e)): Reject

SUBMITTER: Joseph Harackiewicz, Boston, MA

RECOMMENDATION: Revised text:

(e) Other Devices. Other approved devices, such as bonding - type locknuts and bushings or by brazing or welding steel or ferrous locknuts to the metal enclosure and further cleaning the weld prior to inspection by the authority having jurisdiction and protecting with paint or suitable coating thereafter.

SUBSTANTIATION: Brazing or welding of steel or ferrous locknuts to the metal enclosure will provide a reliable conductor connection metal raceway to metal enclosure.

Field welding or brazing has long been recognized in the NEC in 110-14 electrical connections (b) splices as well as in NEC 410-15(b) fixture supports.

Proper field welding or brazing would not loosen with vibration and would prove to be equivalent to screw as permitted by 250-79, or by screws which frequently hold threaded hubs in place

PANEL ACTION: Reject.

PANEL COMMENT: Modification of listed equipment by welding or brazing of locknuts to enclosures can create additional problems such as loss of corrosion protection.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1311

5- 156 - (250-73, Exception-(New)): Reject

SUBMITTER: Nicholas T. Abhatiello, Spencerport, NY

RECOMMENDATION: Add the following "exception."

Raceways in hazardous location containing only nonincendive wiring or only intrinsically safe wiring shall not be required to be bonded in accordance with 250-72 (b) through (e).

SUBSTANTIATION: Paragraph 500-2 does except intrinsically safe wiring for the requirements of Articles 501 through 517, but not from 250-78. Even for nonincendive wiring, having limited energy on them, it would be inconceivable to require special bonding requirements of 250-72(b) through (e). The exception could be expanded to include other limited energy wiring systems such as covered in Articles 725, 800, etc.

Since raceways in hazardous locations, covered by the above exception (if adopted), would invariably tie into other raceways in nonhazardous areas or locations containing power wiring, the nonhazardous location raceways bonding requirements should still meet the requirements of 250-78. This will still then minimize the amount of ground fault current that could flow into the hazardous area via the raceway system.

PANEL ACTION: Reject.

Change reference to 250-78, Exception-(New).

PANEL COMMENT: Raceway could become energized from some other source.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1193

5- 157 - (250-74, Exception No. 4): Reject

SUBMITTER: Jack Wells, Pass & Seymour Incorporated

RECOMMENDATION: Revise 250-74 Exception No. 4 by:

1. Replacing the existing words, "so as to terminated" in the third sentence with, "and shall be terminated".

2. Add a new sentence as follows: "Receptacles other than isolated ground type shall not be permitted to be installed on circuits utilizing isolated ground receptacles".

SUBSTANTIATION: Installation of non-isolated ground type receptacles on circuit utilizing isolated ground devices can result in one or both of the following unacceptable conditions:

1. The isolated grounding conductor becomes bonded to the raceway system at the non-isolated ground type receptacle nullifying the isolated grounding system.

2. The ground contacts of the isolated ground type receptacle are not grounded by not terminating a separate insulated grounding conductor to the terminal screw of the isolated ground device.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is a design consideration. The Panel believes the problem cited in the second paragraph of the substantiation is not solved by the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2408

18- 3 - (250-74, Exception No. 4): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Revise to include new second sentence:

The receptacles shall be identified by an orange triangle located on the face of the receptacle.

SUBSTANTIATION: A standardized marking is needed. Orange colored receptacles may be aesthetically objectionable.

PANEL ACTION: Reject.

PANEL COMMENT: Isolated ground receptacles require very different wiring than conventional receptacles. Frequently, they are miswired defeating their intended function. For example, the grounded jumper from the box is connected to the receptacle ground screw or nonisolated ground receptacles are installed on the same circuit and connected to green insulated grounding conductor required for the isolated ground receptacle. When in use, for maximum effectiveness, equipment not required to be utilized on an isolated ground receptacle (electric pencil sharpener) should not be plugged into such receptacles.

Because of their special function they should be as distinctive as possible.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2092

5- 158 - (250-75, Exception-(New)): Accept in Principle

SUBMITTER: Edward C. Cantwell, Ecos Electronics Corp.

RECOMMENDATION: Add the following:

"EXCEPTION: Where required for the reduction of electrical noise (electromagnetic interference) on the grounding circuit, a non-metallic spacer or fitting shall be permitted between the metallic raceway and the equipment enclosure at the point of attachment of the raceway to the equipment. The metallic raceway shall comply with provisions of this Article and shall be supplemented by an internal insulated equipment grounding conductor installed in accordance with 250-74, Exception No. 4 to ground the equipment enclosure."

SUBSTANTIATION: The reliable performance of sensitive electronic equipment is dependent to a large extent on providing a "clean" source of AC power to operate the equipment. The presence of high frequency electrical noise on the grounding circuit is a frequent cause of malfunction and failure of this type of equipment.

Provisions for an equipment ground reference separate from the metallic raceway system has been adequately covered by Article 250-74, Exception No. 4 for electronic equipment that is cord and plug connected. No specific provision covers a separate equipment ground reference for hardwired sensitive electronic equipment. This has resulted in makeshift installations in the field that violate Article 250 and cause safety hazards for both personnel and equipment.

Acceptance of this Proposal will define how to provide a separate equipment ground reference for hardwired equipment without creating NEC violations and causing safety hazards.

PANEL ACTION: Accept in Principle.

Accept the proposal and add a fine print note as follows:

"(FPN): Use of an isolated equipment grounding conductor does not relieve the requirement for grounding the raceway system and outlet box."

PANEL COMMENT: To alert the Code user that raceways and boxes must still be grounded.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2683

5- 159 - (250-75, FPN-(New)): Reject

SUBMITTER: Joseph Harackiewicz, Boston, MA

RECOMMENDATION: Add (FPN)

(FPN): The method of field brazing or welding of enclosures shall meet the requirements of this section where inspected by the authority having jurisdiction and protected with paint or similar coating thereafter.

SUBSTANTIATION: Same as Proposal 5-155.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-155.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2296

5- 160 - (250-76): Reject

SUBMITTER: Bill Eklund, City of Creston

RECOMMENDATION: Delete: "250 volts" in title and first sentence.

SUBSTANTIATION: Internal knock-out rings are easily broken by installer and user. This will eliminate potential hazards on all voltages.

PANEL ACTION: Reject.

PANEL COMMENT: Submitter has not provided any technical support to warrant a major change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3457A

5- 161 - (250-78, Exception-(New)): Reject

SUBMITTER: Don C. Jewett, The Upjohn Company

RECOMMENDATION:

Exception: Enclosures and raceways enclosing intrinsically safe circuits, and meeting the requirements of Article 725, Part D.

SUBSTANTIATION: Section 250-78 normal equipment grounding practices are sufficient for wiring methods employed for intrinsically safe equipment installed in Hazardous (classified) locations. Safety is assured by the design of equipment to be current limiting, and return of fault currents is at a requirement for system safety.

Section 300-1 added to include additional precautions when installing intrinsically safe equipment in Hazardous (classified) Locations, as provided for other electrical systems described in Chapter 7.

NOTE: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Raceway could become energized from some other source.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 162 - (250-79): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 9 for information.

The Correlating Committee directs the Panel to follow the NEC Style Manual for mandatory wording. This action will be considered by the Panel as a Public Comment.

SUBMITTER: CMP 5

RECOMMENDATION: Insert the following proposal as a new Section 250-79(b) to be placed following the present Section 250-79(a). Reletter the subsections 250-79(b) through (e):

"(b) Construction. Where a main bonding jumper is a screw, provided with the service equipment by the manufacturer, the screw is to be identified with a green finish which is to be visible with the screw installed."

SUBSTANTIATION: After installation, it is frequently difficult to distinguish bonding screws. It is important for inspection purposes that there be no confusion.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: If this is required it should be a requirement of the UL to listed equipment so that it is furnished by the manufacturer.

COMMENT ON VOTE:

ELDRIDGE: The words "by the manufacturer" should be removed from this proposal as being required.

NEMA is not aware of any other section of the Code that has specific requirement stating who has to provide a specific feature required by the Code.

SESSLER: The proposal should be referred to Panel 9 for information and correlation.

Log # 97

5- 163 - (250-79(c)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third and fourth sentences only as indicated:

Where the service-entrance conductors "or cables" are paralleled "comma" (in two or more raceways or cables) the equipment bonding jumper, where routed with the (raceways) "service-entrance conductors" or cables, shall be run in parallel. The size of the bonding jumper (for each raceway or cable) shall be based on the (size of the service-entrance conductors in each raceway or cable.) "equivalent area for parallel conductors or cables as indicated in this Section" and the applicable provisions of Table 250-94."

SUBSTANTIATION: This proposal is intended to provide greater emphasis, clarity and consistency to prevent unsafe and undesirable undersizing of bonding-jumpers when service-entrance conductors are paralleled and as a meaningful reference, Table 250-94 contains this very important information to ensure the proper sizing of the bonding jumpers: "Size of largest service-entrance conductor or equivalent area for parallel conductors"; this is the code-required basis for determining the correct size bonding jumper. This information is applicable to this section (including bonding jumper sizing for non-paralleled service-entrance conductors) and it should be complied with because the meaning/intent of Section 250-79(c) is not clearly understood and as a result a reduced-in-area paralleled service conductor (Phase) leg is used erroneously, in some cases, as the bonding jumper sizing reference per

Table 250-94 instead of correctly complying with the term: "Largest phase conductor or equivalent area for parallel conductors" per Table 250-94. From this, it is clear that "raceway" is not a bonding jumper sizing factor and for this reason this term is being deleted from this section.

Furthermore, it should be noted that A/the supply-side bonding jumper cannot be reduced in size based on reduced-in-size paralleled service-entrance conductors when/if the bonding jumper is to be used to safely conduct fault current likely to be imposed; to do so would: (1) violate the intent of Table 250-94; (2) be contrary to the principles expressed in Article 110-10; and (3) be inconsistent with the principles/intent of Section 250-70. This is an undesirable condition where the imposition of dead-bolt fault current on an under-sized bonding jumper could produce disastrous results.

Next, it should be recalled that the third sentence contains irrelevant/misleading information: "where the service-entrance conductors are paralleled in two or more raceways or cables, the size of the bonding jumper for each raceway or cable shall be based on the size of the service conductors in each raceway or cable"; to do so would violate the intent of Table 250-94 and equally important, the above quoted sentence does not provide bonding jumper sizing procedures/guide-lines for those cases where: (1) non-encased service-entrance conductors are installed; (2) there is only one raceway containing all the paralleled service-entrance conductors; (3) the service-entrance phase conductors in each raceway or cable are not of the same size (this is a widely used practice/procedure); and (4) two or more service-entrance conductors of the same phase are installed in each raceway (this procedure is also widely used).

Since the bonding jumpers in the above cases may have to safely conduct high magnitude fault currents resulting from "worst case" circuit faults, it is imperative that this section be amended to provide viable bonding jumper sizing guide-lines for the conditions specified in 1, 2, 3 and 4 above.

Finally, an approval of this proposal would ensure clear, consistent, valid and meaningful bonding jumper sizing guide-lines with code-level safety for people/property.

(Please see related 1987 changes in Section 250-23(b) in this Code.)

PANEL ACTION: Reject.

PANEL COMMENT: This proposal could require bonding jumpers to be larger than the grounded conductor in each raceway and there is no justification for such a requirement.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 98

5- 164 - (250-79(c)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the fourth sentence only as indicated:

The size of the bonding jumper for each raceway or cable shall be based on the "equivalent area for parallel conductors as indicated in this Section and the applicable provisions of Table 250-94". (Size of the service-entrance conductors in each raceway.)

SUBSTANTIATION: This proposal is intended to provide greater emphasis, clarity and consistency to prevent unsafe and undesirable undersizing of bonding jumpers when service-entrance conductors are paralleled and as a meaningful reference, Table 250-94 contains this very important information to ensure the proper sizing of the bonding jumpers: "size of largest service-entrance conductor or equivalent area for parallel conductors"; this is the code-required basis for determining the correct size bonding jumper. This information is applicable to this section (including bonding jumper sizing for non-paralleled service-entrance conductors) and it should be complied with because the meaning/intent of Section 250-79(c) is not clearly understood and as a result a reduced-in-area paralleled service conductor (Phase) leg is used erroneously, in some cases, as the bonding jumper sizing reference per

Table 250-94 instead of correctly complying with the term: "Largest phase conductor or equivalent area for parallel conductors" per Table 250-94.

Furthermore, it should be noted that A/the supply-side bonding jumper cannot be reduced in size based on reduced-in-size paralleled service-entrance conductors when/if the bonding jumper is to be used to safely conduct fault current likely to be imposed; to do so would: (1) violate the intent of Table 250-94; (2) be contrary to the principles expressed in Article 110-10; and (3) be inconsistent with the principles/intent of Section 250-70.

Next, it should be recalled that the third sentence contains irrelevant/misleading information; "where the service-entrance conductors are paralleled in two or more raceways or cables, the size of the bonding jumper for each raceway or cable shall be based on the size of the service conductors in each raceway or cable"; to do so would violate the intent of Table 250-94 and equally important, the above quoted sentence does not provide bonding jumper sizing procedures/guidelines for those cases where: (1) non-encased service-entrance conductors are installed; (2) there is only one raceway containing all the paralleled service-entrance conductors; (3) the service-entrance phase conductors in each raceway or cable are not of the same size (this is a widely used practice/procedure); (4) two or more service-entrance conductors of the same phase are installed in each raceway (this procedure is also widely used); and (5) the reference to raceway is irrelevant, it has nothing to do with bonding jumper sizing requirements. Since the bonding jumpers in the above cases may have to safely conduct high magnitude fault currents resulting from "worst case" circuit faults, it is imperative that this section be amended to provide viable bonding jumper sizing guide-lines for the conditions specified in (1), (2), (3), (4) and (5) above.

Finally, an approval of this proposal would ensure clear, consistent, valid and meaningful bonding jumper sizing guide-lines with code-level safety for life/property.

(Please see related 1987 changes in Section 250-23(b) in this Code.)

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-165.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1465

5- 165 - (250-79(c)): Accept in Principle

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add a new last sentence to Section 250-79(e) as follows:

"The size of the bonding jumper for a grounding electrode conductor raceway as covered in Section 250-92(b) shall not be required to be larger than the enclosed grounding electrode conductor."

SUBSTANTIATION: The size of the bonding jumper for a grounding electrode conductor raceway is not adequately covered and for a large service could be interpreted as requiring the 12 1/2% rule to be applied. This is not required for the same reason that the 12 1/2% rule does not apply to the grounding electrode conductor.

PANEL ACTION: Accept in Principle.

Add the proposal as a new last sentence to Section 250-79(c).

PANEL COMMENT: To correct a typographical error.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1661

5- 166 - (250-79(c)): Reject

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: Add a new sentence to Section 250-79(c) to read:

"A bonding jumper for a metallic raceway or armor enclosing a grounding electrode conductor shall be of the same size as the grounding electrode conductor contained within the raceway or cable."

SUBSTANTIATION: Section 250-71(a)(3) requires bonding any metallic raceway or armor enclosing a grounding electrode conductor. If the raceway or cable enters concentric or eccentric knockouts punched or formed to impair the electrical connection to ground, Section 250-72(d) requires a bonding jumper. Although the jumper needs to be sized the same as the grounding electrode conductor, that presents a problem in finding a bushing with a large enough lug. In any case, CMP-5 should clarify what size should be used.

PANEL ACTION: Reject.

PANEL COMMENT: Panel believes the intent of the proposal is accomplished by Proposal 5-165.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1986

5- 167 - (250-79(c)): Reject

Secretary's Note: See Secretary's Note on Proposal 5-70.

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: In the second sentence, change "MCM" to "kcmil" in two places.

SUBSTANTIATION: Same as Proposal 5-70.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 5-70.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 99

5- 168 - (250-79(c), Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Add exception (New) after the last sentence as indicated:

"Exception: Factory assembled multiconductor service - entrance cables shall not be paralleled unless the cabled bonding jumpers or grounded conductors, where used, are sized to meet the requirements of Section 250-79(c) and Table 250-94."

SUBSTANTIATION: To ensure proper sizing of bonding jumpers/grounded conductors where 5 or more jacketed or non-jacketed factory assembled service-entrance cables are paralleled the following significant factors should be considered as indicated in cases 1 and 2 below:

CASE 1 (Factory assembled multiconductor jacketed cables with cabled bonding jumpers/grounded conductors as related to code versus ANSI/UL-854-1979.):

Bonding jumper/grounded conductor size for 5 paralleled 250 mcm copper jacketed cables is minimum 156 mcm copper per Section 250-79(c) and Table 250-94.	Bonding jumper/grounded conductor size for two or more 250 mcm copper per Table 6.3, ANSI/UL-854-1979 is minimum 250 mcm copper.
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The above comparisons clearly show that two or more paralleled 250 mcm copper cables per Table 6.3, ANSI/UL-854 do not meet the bonding jumper size requirements of Section 250-79(c) and Table 250-94.

CASE 2 (Factory Assembled multiconductor non-jacketed cable with cabled bonding jumpers/grounded conductors as related to code versus ANSI/854-1979):

Bonding jumper/grounded conductor size for 6 paralleled 250-mcm copper cables per Section 250-79(c) and Table 250-94 is minimum 187 mcm copper.	Bonding jumper/grounded conductor size for two or more 250 mcm copper cables per Table 18.3, ANSI/UL 854-1979 is minimum 150 mcm copper.
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Again, the comparison shows that two or more paralleled 250 mcm copper non-jacketed cables do not meet the bonding jumper or grounded conductor size requirements of Section 250-79(c) and Table 250-94.

NOTE: Aluminum wire was not addressed.

PANEL ACTION: Reject.

PANEL COMMENT: Requirements are adequately covered. See Panel Comment on Proposal 5-163.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 100

5- 169 - (250-79(c), Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 250-79(c), add:

"Exception: The bonding jumper sizing requirements shall apply to both raceway and non-raceway encased service-entrance conductors."

SUBSTANTIATION: Section 250-79(c) provides sizing guidelines for raceway encased service-entrance conductors but there is no bonding jumper sizing reference for non-raceway encased service-entrance conductor. This proposal will correct the omission.

PANEL ACTION: Reject.

PANEL COMMENT: The Code requirements already apply equally to both raceways and nonraceway-encased conductors. A conductor in a cable is still a conductor.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2748

5- 170 - (250-79(c), Exception-(New)): Accept in Principle

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: New text:

Exception: The size of the bonding jumpers that are required by Section 250-92(b) shall not be required to be larger than the enclosed grounding electrode conductor.

SUBSTANTIATION: Present code could require a #1/0 cu bonding jumper to a #6 grounding electrode conductor. Please address this oversight.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Comment on Proposal 5-165.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 638

5- 171 - (250-79(e)): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert "Sections 250-114 and 310-12(b)" in lieu of "Section 310-12(b)".

SUBSTANTIATION: "Bonding" jumpers merit the same termination requirements as grounding conductors.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1298

5- 172 - (250-80, Exception No. 2-(New)): Reject

SUBMITTER: Robert E. Faltings, Phase Three Electric Inc.

RECOMMENDATION: Should include exception, stating:

"If the only grounding electrode is a made electrode (ground rod), the size of Bonding Jumper from the service to an isolated metallic piping system, need not be larger than #6 copper conductor".

SUBSTANTIATION: For services requiring larger than #1 or 0, copper service entrance conductors, the Bonding Jumper to an isolated metallic piping system would have to be larger than #6 copper (per Table 250-94).

Article 250-94, Exception A: Requires the grounding electrode conductor to be no larger than a #6 copper conductor.

It appears to be unnecessary for a Bonding Jumper to be any larger than the grounding electrode, as that is the final path to ground for any developed fault.

PANEL ACTION: Reject.

PANEL COMMENT: The bonding jumper may carry larger fault currents than the grounding electrode conductor to a made electrode.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2369

5- 173 - (250-80(a)(1)): Accept in Principle
SUBMITTER: Joseph McCann, City of Coral Springs, FL
RECOMMENDATION: Revised text:

Where subject to physical damage, this conductor shall be permitted to be run along the surface of the building or protected by means of rigid metal conduit, intermediate metal conduit or rigid nonmetallic conduit.
SUBSTANTIATION: Many times, to bond the water system, the installer will take the grounding electrode conductor to the ground rod and continue on (under ground or under the grass to the water bond bare and unprotected). This subjects this conductor to all the different tools used on lawn maintenance and planting of shrubs. This conductor should be placed in a non-metallic race way so as to afford it some protection.

PANEL ACTION: Accept in Principle.

Insert the following phrase after the words "with Table 250-94": "and installed in accordance with Section 250-92(a) and (b)."

PANEL COMMENT: The Panel believes this action accomplishes proposer's intent and provides clear guidance for installation of bonding conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2323

5- 174 - (250-80(a) and (b); 250-81(a) and 250-44):
Reject

SUBMITTER: George Sickels, Winchester, IN

RECOMMENDATION: Remove:

250-80(a), 250-80(b) and 250-81(a) from the Code and relocate in Section 250-44 Headed: Nonelectric Equipment That May Become Energized.

Remove:

All places in the Code that say to ground to a water pipe.

A copy of my version of the new 250-44 follows:
250-44. Nonelectric Equipment. The metal parts of nonelectric equipment described below which may become energized shall be grounded.

Equipment Grounding Conductor from Supply Side of Service and Main the supply side of the service disconnecting means in reality connects the grounding electrode conductor to the grounded service-entrance conductor.

(a) Cranes. Frames and tracks of electrically operated cranes.

(b) Elevator Cars. Frames of nonelectrically driven elevator cars to which electric conductors are attached.

(c) Electric Elevators. Hand-operated metal shifting ropes or cables of electric elevators.

(d) Metal Partitions. Metal partitions, grill work, and similar metal enclosures around equipment of 1 kV and over between conductors except substations or vaults under the sole control of the supply company.

(e) Mobile Homes and Recreational Vehicles. Mobile homes and recreational vehicles as required in Articles 550 and 551.

(FPN): the practice of using a plastic pipe for replacement when the original metal water pipe fails from corrosion, leaves the system without a ground:

(a) Metal Underground Water Pipe. A metal underground water pipe in direct contact with the earth for 10 feet (3.05 m) or more (including any metal well casing effectively bonded to the pipe) and electrically continuous (or made electrically continuous by bonding around insulating joints or sections or insulating pipe) shall be bonded to the equipment grounding conductor sized in accordance with Section 250-94, and shall be connected in the manner specified in Section 240-115.

(a) Metal Water Piping. The interior metal water piping system shall be bonded to the equipment grounding conductor.

The bonding jumper shall be sized in accordance with Table 250-95. The points of attachment of the bonding jumper shall be accessible.

In buildings of multiple occupancy, where the interior metal water piping system for the individual occupancies is metallically isolated from all other

occupancies by use of nonmetallic water piping, the interior metal water piping system for each occupancy shall be bonded.

The bonding jumper shall be sized in accordance with Table 250-95.

(b) Other Metal Piping. Interior metal piping which may become energized shall be bonded to the equipment grounding conductor for the circuit sized in accordance with Table 250-95 using the rating of the circuit which may energize the piping.

(FPN): Bonding all piping and metal air ducts within the premises will provide additional safety.

(FPN): Where extensive metal in or on buildings may become energized and is subject to personal contact, adequate bonding and grounding will provide additional safety.

This fine print note is addressing such constructions as metal siding on buildings. As this is not electric equipment, it is outside the scope of the National Electrical Code [see Section 90-2(a)], and the Code cannot require that it be grounded. Grounding of metal siding that is likely to become energized and is subject to contact by persons is, however, an excellent safety precaution.

See Section 547-8 for grounding and bonding of agricultural buildings.

Paragraph 3.14a. of the National Fuel Gas Code, NFPA 54-1984, ANSI Z223.1-1984, requires that each aboveground portion of a gas piping system upstream from the equipment shutoff valve shall be electrically continuous and bonded to any grounding electrode, as defined by the National Electrical Code, ANSI/NFPA 70.

SUBSTANTIATION: The use of plastic for the installation, repair and replacement of metal water pipes and other piping has or will render a metal water pipe useless as a ground electrode.

They manufacture any plumbing connection you want out of plastic. It is cheap, readily available and anyone can use it.

Plumbers and Do-It-Yourselfers don't have copies of the National Electric Code. Manufacturers and sales people don't tell anyone to use bonding jumpers when using plastic.

Anything that is to be grounded should be grounded as specified elsewhere in Code and not depend on water pipes. These pipes should be bonded to take care of ground faults.

As WATER PIPE is so misunderstood, I feel this revision should be adopted now and not wait until 1990.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: If the water pipe is used as a grounding electrode, it must be supplemented.

If the metal water pipe is on the premises it should be used as part of the grounding system for safety and therefore the requirements should remain in Sections 250-80 and 250-81.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2144

5- 175 - (250-81): Accept in Principle
SUBMITTER: R. K. Weinzler, LeRoy, NY

RECOMMENDATION: In the second line, after "(a) through (d) below" add ", and any made electrodes in accordance with 250-83."

SUBSTANTIATION: It is the intention of Section 250-81 that all grounding electrodes available on the premises at each building or structure served be bonded together. The current Code assumes that there will not be any made electrodes present if a grounding system complies with 250-81. Many instrument manufacturers strongly recommend a separate grounding system independent of the building ground to be installed for their equipment to minimize signal noise on the ground line. There is no problem with adding a made electrode to a building to be used as a low noise ground. There is a problem if this electrode is not bonded to the building grounding electrode system. Presently, the Code does not address the existence of a made electrode within a building.

PANEL ACTION: Accept in Principle.

Revise the proposal by changing "250-83" to "Sections 250-83(c) and (d)."

PANEL COMMENT: To make a specific reference to made electrodes.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2918

5- 176 - (250-81): Reject

SUBMITTER: George O. Stiles, Stiles Electric Service

RECOMMENDATION: Delete the wording "If available on the premises" and replace with "If present on the premises."

SUBSTANTIATION: The need for better and more adequate grounding electrode systems is recognized by the electrical industry in general. In recognition of this fact, it appears that the Code Making Panel by the wording of 250-81 mandated that the various individually acceptable electrodes be bonded together to form a grounding electrode system of higher quality than any one of the individual electrodes. Because of the use of the word "available" this concept is not being enforced by inspectors with the blessing of some national authorities. The rationalization is that systems such as reinforcing bars in foundations and sometimes structural steel are not available (already covered) when electricians arrive on the job. Electricians provide temporary power sources, install sleeves, etc., at an early stage of construction. It should not be an undue hardship to comply with the apparent intent of this Code section.

There are many problems in this area such as how to treat a service change to an already constructed building. Adoption of this proposal would be a step toward eliminating a loop hole and acquiring better quality grounding electrode systems.

PANEL ACTION: Reject.

PANEL COMMENT: "Available" is intended. It is not intended to break into concrete to expose rebar which is present, or to dig trenches to attach to well casings.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2919

5- 177 - (250-81, 250-83): Reject

SUBMITTER: George O. Stiles, Stiles Electric Service

RECOMMENDATION: 250-81 Change heading to read "Building Systems Utilized as Grounding Electrode System."

(a) Remain as at present.

(b) Remain as at present.

(c) Change heading to read "Concrete Encased Reinforcing Bars."

Delete "or consisting of at least 20 feet (6.1 m) of bare copper conductor not smaller than No. 4 AWG."

(d) Delete and relocate to 250-83(b) Ground Ring.

New (d) Present 250-83(a) Metal Underground Gas Piping System.

New (e) Present 250-83(b) other local metal underground systems or structures.

250-83 Delete "and other" from heading

(a) Delete and relocate to 250-81(d) Metal Underground Gas Piping System.

New (a) Present 250-83(c) Rod and Pipe Electrodes

(b) Delete and relocate to 250-81(e) Other Local Metal Underground Systems or Structures.

New (b) Present 250-81(d) Ground Ring.

(c) Delete and relocate to 250-83(a) Rod and Pipe Electrodes.

New (c) Repeat present 250-81(c) with deletion of "consisting of at least 20 feet (6.1 m) of one or more steel reinforcing bars or rods of not less than 1/2 inch (12.7 mm) diameter, or"

(d) Remain as at present.

SUBSTANTIATION: Suggested arrangement of material does not change the technical requirements for grounding, but is a more readily understood and logical approach to conditions that existing in practice. Building systems as proposed for 250-81 are provided as a part

of the structure by others for other purposes and in truth are borrowed by the electrical system for grounding purposes. They are generally massive, more nearly permanent, and more effective than truly "made electrodes" which have no other purpose than to serve as ground electrodes.

PANEL ACTION: Reject.

PANEL COMMENT: Submitter has not supported the technical change for concrete encased electrodes.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3166

5- 178 - (250-81): Reject

SUBMITTER: John P. Leith, Fairfield, AL

RECOMMENDATION: At least two ground rods 8' in length 5/8" in diameter to be driven at each service installation. They shall be at least 1 foot between them.

SUBSTANTIATION: Sometimes a ground rod is the only source of grounding safety.

PANEL ACTION: Reject.

PANEL COMMENT: Nothing is proposed nor any technical support provided.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2378

5- 179 - (250-81, Exception-(New)): Reject

SUBMITTER: Robert L. Simpson, The Institute of Electrical and Electronics Engineers, Inc.

RECOMMENDATION: At the end of the first paragraph add:

Exception 1: In industrial and commercial locations it shall be permitted to extend the grounding electrode conductor by means of the exothermic welding process.

SUBSTANTIATION: The design of large multi-building factories and/or commercial buildings, in which numerous substations are to be installed, involves many individual grounding electrode conductors. These conductors are attached to the grounding electrode below grade and extended thru the concrete slabs to the required locations. At times, due to either a late change in the system or equipment design, it is necessary to extend them. Many times they are damaged by other construction trades prior to the installation of the substations. Since it is impractical to tear up the concrete slabs to replace the damaged conductors, it has been a common practice to extend them by means of the exothermic welding process.

Since Part K of Article 250 permits the use of the exothermic welding process in the grounding connection (Section 250-113 and 250-115), its reliability as a connecting means has already been accepted.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not believe that the requirement of an unspliced grounding electrode conductor should be relaxed. There is no demonstrated need.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: McIntosh, Neiswender, Pittman, Toomer.

EXPLANATION OF VOTE:

MCINTOSH: I believe the Panel Action should be changed to "accept" for the reasons as described in the "Substantiation". There is a demonstrated need in the "Substantiation" for permission to extend the grounding electrode conductor by means of the exothermic welding process—a practice widely accepted by the utility and large industrials for many years.

NEISWENDER: In large industrial plant's construction, it is often necessary to add an extension to the various grounding electrode conductors which are installed for later use when the electrical equipment is put in service. This extensions are the result of many inadvertent actions during the construction of the plant. Examples of these actions are (1) the use of heavy forklift loads running in poorly lighted areas; (2) severing of the bare copper conductors by other trades so that they may use the copper for other purposes; and (3) the location may not have been correct for the equipment that was purchased from multi-bidders.

PITTMAN: Exothermic welding is a proved method of joining and is commonly used in industrial and utility installations.

TOOMER: The exothermic welding process would make a permanent connection. The use of a mechanical connector is not a permanent connection.

Log # 2206

5- 180 - (250-81, FPN-(New)): Accept

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.

RECOMMENDATION: Insert the following (FPN) at end of Section.

(FPN) See Section 547-8 for special grounding and bonding requirements for agricultural buildings.

SUBSTANTIATION: The requirements of Section 547-8(a) are much more restrictive than Section 250-24. It is very easy to overlook these requirements if someone is using Article 250 for grounding requirements. We have been taught to use Article 250 for all grounding, and now we have another set of rules to comply with but no reference to them.

PANEL ACTION: Reject.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 856

5- 181 - (250-81(a)): Reject

SUBMITTER: John Jansen, City of Paterson, NJ

RECOMMENDATION: The supplemental electrode shall be bonded to the main neutral block.

SUBSTANTIATION: The way the section is written you are actually bonding the water pipe more than the service. With the above proposal we are sure the service is properly bonded also.

PANEL ACTION: Reject.

PANEL COMMENT: There is no technical support for this more restrictive proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 358

5- 182 - (250-81(b)): Reject

SUBMITTER: Bob Middleton, Pocatello, ID

RECOMMENDATION: Revise to read:

"The metal frame of the building shall be supplemented by an additional electrode of A type specified in Section 250-81 or in Section 250-83."

SUBSTANTIATION: The present wording leaves too much to chance. Both the inspector and the electrician do not know for sure that the metal frame of the building is effectively grounded.

PANEL ACTION: Reject.

PANEL COMMENT: There is no evidence provided that the grounded frame of the building does not provide adequate building ground. Experience shows it is many times superior to the supplementary electrode suggested.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 766

5- 183 - (250-81(b)): Reject

SUBMITTER: Douglas N. Buhler, Preston, ID

RECOMMENDATION: Revise text to read:

The metal frame of the building, where effectively grounded, with an supplemental ground rod also attached to the frame of building.

SUBSTANTIATION: To make sure frame of building is grounded to earth.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-182.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 767

5- 184 - (250-81(b)): Reject

SUBMITTER: Randy Larsen, Pocatello, ID

RECOMMENDATION: The metal frame of the building when supplemented by a ground electrode.

SUBSTANTIATION: The metal frame of the building may not always be effectively grounded, so the Code should also include a ground electrode to ensure proper grounding.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-182.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 768

5- 185 - (250-81(b)): Reject

SUBMITTER: Jim L. Chaney, R. Homes

RECOMMENDATION: Add:

Metal frame of building should be supplemented by grounding electrode of a type specified in Section 250-81 and 250-83.

SUBSTANTIATION: Metal frame of building is not a substantially qualified grounding electrode, to stand by itself as the only grounding means for an electrical system. The metal frame is not always in direct contact with the earth to form a qualified grounding system.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-182.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2409

5- 186 - (250-81(b), (c), (d)): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Revise Section 250-81(b) to be 250-81(d),

250-81(c) to be 250-81(b), and

250-81(d) to be 250-81(c)

SUBSTANTIATION: The order should be a pecking order and Section 250-81(b), "Metal Frame of the Building" is the least effective of all the grounding electrodes of Section 250-81 according to Richard Kaufmann's AIEE paper of 1954. This section should be in descending order.

PANEL ACTION: Reject.

PANEL COMMENT: The order does not suggest a degree of acceptability.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2182

5- 187 - (250-81(b), FPN No. 1 and No. 2-(New)): Accept in Principle

SUBMITTER: Stephen C. Ritzenthaler, City of Sandusky, OH

RECOMMENDATION: New text:

250-81 Grounding Electrode System.

b. Metal Frame of the Building. The metal frame of the building, where effectively grounded.

(FPN): Reference 800-2c.1.). FPN for definition of "effectively grounded".

(FPN): Reference NFPA 78-1985 Volume 3 for similar grounding requirements with respect to the number of grounded terminals, location, and connection.

SUBSTANTIATION: The term "effectively grounded" is vague and is subject to individual interpretation and controversy. A more definitive and explicit reference would remedy this condition. The only location to reference a definition of "effectively grounded" is in NEC Section 800-2c.1.).

Apparently, previous editions of the Ohio Basic Building Code (OBBC) stated such requirements but have since been deleted. The deletion appears to have caused confusion among designers, contractors, and developers in this geographic region. As a result, no concrete method is available as to what requirements are necessary to achieve proper grounding for metal frames of buildings.

I believe the Proposal will serve as a guideline as to what constitutes an effectively grounded metal building. Furthermore, the Proposal will assist Electrical Inspectors by enforcing uniform requirements to assure adequate grounding is installed in accordance to the intent of the NEC.

PANEL ACTION: Accept in Principle.

Insert the same fine print note which appears in Section 800-2(c)(1)d. as a new fine print note to Section 250-81(b).

PANEL COMMENT: The Panel rejects the second fine print note since it is not pertinent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 813

5- 188 - (250-81(c)): Reject

SUBMITTER: Harvey J. MacGregor, MacElec. Industries Ltd.

RECOMMENDATION: Add to Article 250-81(c) "or a plate electrode as specified in Article 250-83(d)".

If accepted Article 250-81(c) would read as follows:

An electrode encased by at least 2 inches (50.8 mm) of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth, consisting of at least 20 feet (6.1 m) of one or more steel reinforcing bars or rods of not less than 1/2 inch (12.7 mm) or consisting of at least 20 feet (6.1 m) of bare copper conductor not smaller than number 4 A.W.G., "or a plate electrode as specified in Article 250-83(d)."

SUBSTANTIATION: It is well known that any electrode imbedded in the lower 2 inches (50.8 mm) of a concrete footing or foundation will offer less resistance to ground.

Our MacElectrode meets or surpasses all of the requirements of Article 250-83(d) and because it has twice the surface area required, I feel it complies with Article 250-84.

If our plate electrode is accepted for direct earth burial (we have C.S.A. and U.L. listing) then concrete encasement should improve the grounding qualities. (We have C.S.A. approval for concrete encasement.)

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Concrete-encased electrode in Section 250-81(c) is a preferential electrode to the plate electrode covered in Section 250-83(d). There is no technical support to justify the proposed change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2410

5- 189 - (250-81(c)): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Revise Section 250-81(c) to insert the following sentence after the heading:

All new construction shall include this grounding electrode.

SUBSTANTIATION: Tests to date have concluded that this is the most effective grounding electrode. It is also cost effective.

PANEL ACTION: Reject.

PANEL COMMENT: Submitter has not provided any technical support or data.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1332

5- 190 - (250-81(c), FPN-(New)): Reject

SUBMITTER: Craig E. Herold, Exchange Carrier Standards Association

RECOMMENDATION: Add the following fine print note:

FPN: Bonding other reinforcing rods or mesh to the grounding electrode system within the premises will provide additional safety.

SUBSTANTIATION: We have now reached the point where virtually all new water entrances to single family dwellings are made with plastic or some other

nonconductive material. This is the case when a municipal water system entrance is used and is also the case where a well is drilled outside of the structure and water is brought in.

There is also an increased tendency to use basements as living or workshop area rather than for storage. This means that most newer basements are eventually equipped with power tools, electrical devices, and telephones.

We presently require that the power system be bonded to the water system but as noted above this does not contribute to an improvement in the site grounding because we now use nonmetallic entrance pipe. This connection to the water system is important in the fact that it does help to equalize potentials in the structure, however, the use of nonconducting pipe is also becoming common within the structure. We should insert the new FPN to allow for additional equalization in regard to residences with poured concrete floors when the floor are constructed with reinforcing mesh.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel agrees with the concept, but the intent is met by a number of fine print notes in Sections 250-80(a) and 250-86. It is necessary to limit the number of fine print notes.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Sessler.

EXPLANATION OF VOTE:

SESSLER: I believe the note will be useful in this Section.

Log # 2411

5- 191 - (250-81(e)-(New)): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: New text:

(e) Ground Grid. A system of grounding electrodes consisting of electrically interconnected bare cables buried beneath the structure to provide a common grounding electrode.

SUBSTANTIATION: This system is commonly employed by commercial generating establishments but has been used by ordinary and residential structures.

PANEL ACTION: Reject.

PANEL COMMENT: This type of grounding system is only valid in areas of the country with consistently high water tables. If used in structures of any appreciable size, and no area high water table, they end up as very high resistance grounding electrodes, since surface water seldom penetrates into these areas.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2749

5- 192 - (250-83): Reject

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Revise the first sentence:

"Where none of the electrodes specified in Section 250-81 is available, two or more . . ."

Delete in the fourth sentence: Where more than one electrode is used . . .

SUBSTANTIATION: Presently there is no Code section to prevent one eight foot ground rod as the electrode system for an 800 ampere service or 200 ampere residential service. Section 250-84 is fine but the authority having jurisdiction needs the emphasis reversed since he obviously will not have the proper testing equipment nor time to test for 25 ohms resistance!

PANEL ACTION: Reject.

PANEL COMMENT: The proposed change is duplication which may not be needed and there is no substantiation provided.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 193 - (250-83(a)): Reject
SUBMITTER: Alan H. Nadon, City of Elkhart, IN
RECOMMENDATION: Revise text:
 (a) Metal Underground Gas Piping System. Gas piping shall not be used as a grounding electrode.
SUBSTANTIATION: 1. Some electrical contractors request permission to use gas piping as a ground electrode which is usually refused by the local authority and should be refused by every utility that has adopted the National Fuel Gas Code - Volume 4 NFC Z 2223.1-30 (54-30) Section 3.14 Electrical Bonding and Grounding. Related to gas piping systems.
 2. To make NFPA publications of the NFC consistent NFPA 70 and NFPA 54.
PANEL ACTION: Reject.
PANEL COMMENT: Present wording requires acceptance from the gas supplier and the authority having jurisdiction.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 9
 NEGATIVE: McIntosh, Sessler.

EXPLANATION OF VOTE:

MCINTOSH: I believe the Panel Action should be changed to "accept". This proposal continues to appear each Code cycle--for very good reasons as contained in the "Substantiation". I think it is time to disallow the use of metal underground gas piping systems as a grounding electrode.

SESSLER: I believe it is time to eliminate the permissible use of gas piping as a grounding electrode which is apparently never granted by the gas utility and is in conflict with NFPA 54 - 3.14(b) which states "gas piping shall not be used as a grounding electrode."

5- 194 - (250-83(a)): Reject
SUBMITTER: Michael M. Hayes, Grand Rapids, MI
RECOMMENDATION: Revised text:
 (a) Metal Underground Gas Piping System. Metal underground gas piping systems shall not be used as a grounding electrode system.
SUBSTANTIATION: Gas piping systems typically have insulating sections and/or joints as well as non conductive coatings as part of corrosion control efforts. These insulators and coatings are installed without warning and may eliminate the required grounding electrode system.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 5-193.
VOTE ON PANEL ACTION:
 AFFIRMATIVE: 9

NEGATIVE: McIntosh, Sessler.

EXPLANATION OF VOTE:

MCINTOSH: I believe the Panel Action should be changed to "accept". See my comment to Proposal 5-193.
 SESSLER: Same as Proposal 5-193.

5- 195 - (250-83(b)): Reject
SUBMITTER: Harry W. Burns, Burns Electric, Inc.
RECOMMENDATION: Revise as follows:
 250-83(B) Other Local Metal Underground Systems or Structures. Other Local Metal Underground Systems or Structures, such piping systems, underground rigid metal conduit minimum 1/2" x 30' or equivalent, and underground tanks.
SUBSTANTIATION: Rewrite 250-83--(b) to include the use of underground metal conduit as a Made or other Electrode. This Made Electrode could have less resistance than a minimum 8' rod especially where there is a metal underground service and other underground conduits.
PANEL ACTION: Reject.
PANEL COMMENT: Submitter has provided no technical data to support the proposal. Metal conduits installed underground may be insulated for corrosion protection.
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 196 - (250-83(c)(1)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add:
 "Couplings or other joints shall not be permitted in the first 8 feet (2.44 m) buried section of pipe or conduit from the point of attachment of the grounding or bonding conductor."
SUBSTANTIATION: Though some nonferrous rods have coupling arrangements, pipe or conduit couplings should be restricted as loose joints in such driven electrodes are not easily discernable. Threaded joints (which may not be watertight) especially field cut threads where galvanizing is removed are prone to rust and corrode and result in higher impedance.
PANEL ACTION: Reject.
PANEL COMMENT: Not technically supported and not enforceable.
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 197 - (250-83(c)(2)): Accept
SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association
RECOMMENDATION: Revise to read:
 "Electrodes of rods of iron or steel shall be at least 5/8 inch (15.87 mm) in diameter. Nonferrous or stainless steel rods or their equivalent less than 5/8 inch (15.87 mm) in diameter shall be listed and shall not be less than 1/2 inch (12.7 mm) in diameter."
SUBSTANTIATION: To clarify that stainless steel rods less than 5/8" in diameter are to be listed and may be 1/2 inch in diameter.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 198 - (250-83(e)-(New)): Accept in Principle
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add:
 "Aluminum electrodes shall not be permitted."
SUBSTANTIATION: The present requirements do not specifically exclude aluminum. Subsection (c)(1) states where of iron or steel, which does not exclude aluminum; (c)(2) excludes aluminum indirectly due to the listing requirement; (d) nonferrous metal includes aluminum.
PANEL ACTION: Accept in Principle.
 Insert the proposal as a new Section 250-83(e) with the heading "Aluminum Electrodes."
PANEL COMMENT: Changes made to conform with NEC Style Manual.
VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 199 - (250-84): Reject
SUBMITTER: Ronny S. Smith, Western Engineering
RECOMMENDATION: Revise as follows:
 "250-84: Resistance of Made Electrodes.
 A test shall be conducted at the time of installation to insure that the resistance to ground is 25 Ohms or less, using the procedure in a, b or c below. A record of this test shall be attached to the nearest electrical enclosure.
 (a) Triangulation or three point method
 (b) Ratio methods
 (c) Fall- of Potential Method
 (Procedures for these tests are included in the operation manual for the type of instrument being used)
 A single electrode consisting of a rod, pipe, or plate which does not have a resistance to ground of 25 Ohms or less shall be augmented by additional electrodes of any of the types specified in Section 250-81 or 250-83. Where multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall be not less than 6 feet (1.83 m) apart.

(FPN): The paralleling efficiency of rods longer than 8 feet (2.44 m) is improved by spacing greater than 6 feet (1.83 m)

Specifications for Grounding Electrode Conductors connecting additional electrodes shall comply with Section 250."

SUBSTANTIATION: The Code as now written does not specifically require that resistance to ground be tested. Being an Electrical Contractor and having worked for others I have found that installing a rod or other types of grounding electrodes has been assumed as being sufficient.

In those cases where the resistance to ground has been tested and the resistance is more than 25 Ohms, (one) additional electrode is installed.

There is no requirement for anything further to be done.

As an Engineering firm, we have installed many additional electrodes at various distances and have found in many cases, most in fact, that one additional electrode spaced at 8 - 10 and even 15 feet makes very little difference in measured resistance to ground.

Point: If we are going to make reference to 25 Ohms or less, then let's set forth procedures for testing and insuring that it is complied with. If this is not acceptable then let's delete all reference to a 25 Ohm standard.

PANEL ACTION: Reject.

PANEL COMMENT: The requirement of 25 ohms or less is already covered by the Code, and testing is required to determine compliance. The NEC does not describe the test method.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2412

5- 200 - (250-84): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Revise as follows:

- (1) A single "primary" electrode consisting of . . .
- (2) Where multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall be not less than "16" feet "(4.85 m)" apart.
- (3) Delete (FPN).

NOTE: Added material in quotations.

SUBSTANTIATION: (1) By designating this as a "primary" electrode, inspection authorities will not require an additional ground rod when a metal underground water pipe exists that is at least 10 ft long.

(2) A rod (pipe) that is 8 ft vertically in the earth will be effective for a radius of 8 ft at the point where the electrode is driven per E. D. Sunde (1949, Earth Conduction Effects in Transmission Systems, D. Van Nostrand Co. Inc.).

(3) The (FPN) is unnecessary if (2) is accepted.

PANEL ACTION: Reject.

PANEL COMMENT: There is no definition of primary. There is no justification for 16-foot separation. Since the 16-foot separation was not accepted, the FPN is needed.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3342

5- 201 - (250-84 and FPN-(New)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Replace the first sentence with the following, and add a new FPN:

A single electrode consisting of a rod, pipe or plate which does not have a resistance to ground of 25 ohms or less shall be augmented by one or more additional electrodes of any of the types specified in Section 250-81 or 250-83, all effectively bonded together, such that the paralleled electrodes will have a resistance to ground of 25 ohms or less.

(FPN): Deeply driven or buried electrodes may be more effective than paralleled rods in reducing ground resistance.

SUBSTANTIATION: The apparent intent of Section 250-84 is to achieve a resistance to ground of 25 ohms or less. The provision of one additional electrode, in many cases, will do little towards achieving a 25 ohm resistance. Further, it has been argued in some quarters that the literal wording of Section 250-84 allows one, and only one, additional electrode.

The proposed FPN is submitted in the same spirit as the existing FPN, as an advisory comment.

PANEL ACTION: Reject.

PANEL COMMENT: It is not the Panel's intent to require more than two electrodes irrespective of their combined resistance.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1885

5- 202 - (250-91): Reject

SUBMITTER: Kenneth Nielson, State of MI

RECOMMENDATION: Delete:

250-91(B). Types of equipment grounding conductors. The equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following: (1) a copper or other corrosion resistant conductor. This conductor shall be solid or standard; insulated, covered, or bare; and in the form of a wire or a busbar of any shape; (2) rigid metal conduit; (3) intermediate metal conduit; (4) electrical metallic tubing; (5) armor of type ac cable; (6) the sheath of mineral-insulated, metal-sheathed cable; (7) the metallic sheath or the combined metallic sheath and grounding conductors of Type MN cable; (8) cable trays as permitted in Section 318-3(c) and 318-7; (9) other electrically continuous metal raceways listed for grounding.

SUBSTANTIATION: This would assure that an effective and continuous grounding path is maintained.

Our field experience shows a consistent problem with lost ground paths where flexible metal conduit is used to wire equipment that is not fixed in place.

This amendment would assure that a continuous grounding is maintained.

PANEL ACTION: Reject.

PANEL COMMENT: No technical support to justify the elimination of flexible metal conduit as an equipment grounding conductor under any conditions.

Concern for loss of ground path where equipment is not fixed in place is covered in Section 350-5, Exception No. 2.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1467

5- 203 - (250-91(a), Exception No. 2): Accept

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add a new last sentence to Section 250-91(a) Exception No. 2 as follows:

The tap conductors shall be connected to the grounding electrode conductor in such a manner that the grounding electrode conductor remains without a splice or joint.

SUBSTANTIATION: To clarify the intent that the main, full size grounding electrode conductor is to be installed without a splice or joint and that the tap conductors may be connected to it, for example by a split bolt connector or exothermic weld without opening the grounding electrode conductor.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2379

5- 204 - (250-91(a), Exception No. 3-(New)): Reject

SUBMITTER: R. L. Simpson, The Institute of Electrical and Electronics Engineers, Inc.

RECOMMENDATION: At the end of the first paragraph add:

Exception 3: In industrial and commercial locations it shall be permitted to extend the grounding electrode conductor by means of the exothermic welding process.

SUBSTANTIATION: Same as Proposal 5-179.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 5-179.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: McIntosh, Neiswender, Toomer.

EXPLANATION OF VOTE:

MCINTOSH: See my comment on Proposal 5-179.

NEISWENDER: In large industrial plant's construction. It is often necessary to add an extension to the various grounding electrode conductors which are installed for later use when the electrical equipment is put in service. This extensions are the result of many inadvertent actions during the construction of the plant. Examples of these actions are (1) the use of heavy forklift loads running in poorly lighted areas; (2) severing of the bare copper conductors by other trades so that they may use the copper for other purposes; and (3) the location may not have been correct for the equipment that was purchased from multi-bidders.

It has been a long standing and successful practice to extend these grounding electrode conductors using the exothermic process.

TOOMER: Same as Proposal 5-179.

Log # 241

5- 205 - (250-91(b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the fourth line in the section as indicated:

... conductor (.) "sized in accordance with Section 250-95." This conductor shall be solid or

SUBSTANTIATION: In the interest of safety, this revision should be made to conform to the requirements specified in Section 250-95/Table 250-95.

PANEL ACTION: Reject.

PANEL COMMENT: This is an unnecessary reference, Section 250-91(b) lists the types of equipment grounding conductors. Section 250-95 provides the size of equipment grounding conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 641

5- 206 - (250-91(b)): Accept in Principle

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"cablebus framework as permitted in Section 365-2" as item (10) and make present item (10) item (11).

SUBSTANTIATION: To provide correlation with Section 365-2 which permits such an equipment grounding conductor.

PANEL ACTION: Accept in Principle.

Change the reference in the proposal to "Section 365-2(a)."

PANEL COMMENT: To make a specific reference to a permissible use.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1875

5- 207 - (250-91(b)): Reject

SUBMITTER: Charles J. Hart, National Electrical Contractors Association

RECOMMENDATION: Revise Section 250-91(b) to read:

(b) For Conductor Enclosures and Equipment Only. The grounding conductor for equipment and for conduit and other metal raceways or enclosures for conductors shall be one of the following:

(1) A conductor of copper or other corrosion-resistant material, stranded or solid, insulated or bare. If run in conduit or raceway with current-carrying conductors, it shall be insulated and identified by a green color or green with one or more yellow stripes.

(2) A busbar.

(3) The armor of Type AC cable.

(4) The sheath of mineral-insulated, metal-sheathed cable.

(5) The metallic sheath or the combined metallic sheath and grounding conductors of Type MC cable.

All bolted or threaded connections at joints and fittings shall be made tight by the use of suitable tools.

SUBSTANTIATION: The grounding conductor is an essential safety element of a circuit under ground-fault conditions. A wide variety of raceways and fittings now in use have no specified resistivity, ampacity, or I²t performance, and therefore raceways cannot be relied upon to provide the effective grounding path required by Section 250-51.

Bare conductors may damage insulated conductors where both are installed together in conduit.

For marinas and boatyards (555-7) and swimming pools (680-25), the NEC requires an insulated equipment grounding conductor run with the circuit conductors, recognizing that a raceway system is not inherently a reliable electrical conductor. The Reed Creek Improvement District (Disney World, Florida) and many knowledgeable industrial establishments, based on their own experience, also require the additional grounding conductor in the interest of safety and satisfactory operation. At intervals of 10 feet or less throughout its length, a raceway system has joints or terminations, often not accessible for inspection, that may and on occasion do become loose, rusted, or corroded so as to impair electrical conductivity. The intent of this proposal is to provide the same level of equipment-grounding reliability for all installations as is now required for marinas and swimming pools and many industrial plants.

PANEL ACTION: Reject.

PANEL COMMENT: There is no valid technical support to justify this proposal.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Bessine, Reardon, Toomer.

EXPLANATION OF VOTE:

BESSINE: Reason for not voting with panel on Proposal #05 207 - Added substantiation is that many underground conduits deteriorate or separate which causes a high resistance ground or no ground at all. The Panel Comment: There's no valid technical support to justify this proposal.

With over 25 years of experience in the field, I have seen many times where the raceway is not sufficient grounding.

REARDON: Mr. Hart (the submitter) has correctly stated that "a wide variety of raceways and fittings now in use have no specified resistivity, ampacity or i²t performance". This is sufficient technical support to justify acceptance of the proposal. The technical substantiation presented to the panel with Proposal 05 210, Log 3187, also supports Mr. Hart's proposal.

TOOMER: It has been proven that metallic conduit that is buried or in contact with earth or in concrete will corrode and lose its ability to function as a grounding conductor. Metallic conduit that is concealed can become loose and/or not continual due to actions by others.

Log # 2839

5- 208 - (250-91(b)): Reject

SUBMITTER: Rajni S. Mehta, The Wiremold Company

RECOMMENDATION: Revise Item (10) of 250-91(b) as following:

Other electrically continued metal raceways approved for grounding.

SUBSTANTIATION: Surface Metal Raceways are tested by UL in accordance with UL-5 which requires that all connections of raceways be continuous and meet a maximum of .005 ohms per connections. Based on this data inspectors were able to approve an installation of Surface Metal Raceway. With the Code change to read, LISTED the decision has been taken out of the electrical inspectors hands. Since UL does not state in their Green book that raceways are listed as equipment ground conductors, electrical inspectors are rejecting their use. This is contrary to a use that has been in existence since the 1971 Code. Since there has been no action on the part of UL that the Green book will be amended we request that the Code be changed back to permit the electrical inspector to make the judgment.

We offer the enclosed letter from UL as proof that Surface Metal Raceways were considered as proper equipment grounding conductors.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

Request that TIA be issued until time that UL provides means of getting raceway Listed on white card, if above recommendation is not accepted.

PANEL ACTION: Reject.

PANEL COMMENT: It is the intent that these raceways be listed, not just acceptable to the authority having jurisdiction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3161

5- 209 - (250-91(b)): Reject

SUBMITTER: John P. Leith, Fairfield, AL

RECOMMENDATION: The equipment grounding conductor shall be a wire of copper solid or stranded, covered or bare installed in one continuous length without a splice or joint. It can be installed in the raceway or along the side but must be along with the ungrounded conductor. If covered the color shall be green. No kind of raceway or any other way (just as stated).

SUBSTANTIATION: I think this way is the safest and it will stop a lot of problems in the electrical field.

PANEL ACTION: Reject.

PANEL COMMENT: There is no technical support provided and in some cases this would be impossible to install.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3187

5- 210 - (250-91(b)): Reject

SUBMITTER: Charles W. Forsberg, The Carlon Company

RECOMMENDATION: Revised text:

(b) Types of Equipment Grounding Conductors. The equipment grounding conductor run with the circuit conductors shall be a copper or other corrosion-resistant conductor. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire.

Exception: For direct-current circuits only, the equipment grounding conductor shall be permitted to be run separately from the circuit conductors.

SUBSTANTIATION: This proposal removes the recognition that metallic raceways and cables are appropriate equipment grounding conductors.

Fire investigation records of commercial buildings and military facilities show that metal raceways or cables are identified as the ignition source in a number of fires over recent years. Twelve such instances were identified in a Factory Mutual Technical Report, "A Review of Factory Mutual Reports of Losses of Electrical Origin Involving Metal Conduits," by D. M. Karydas, FMRC J.I. ONOR3.RU, July, 1986. A Shore Fire Management Report, prepared by the Naval Safety Center covering a period from April, 1982 through April, 1987 shows fires at seven U.S. military buildings were related to metallic raceways or cables. Also, the official NFPA investigation report of the tragic MGM fire indicates an arc between flexible aluminum conduit and EMT was the cause of the fire.

Most engineers and electricians do not dispute that metal raceways and cables have been identified as the ignition source in fires. Poor workmanship is generally thought to be responsible for creating the conditions which might later be responsible for ignition. The most common oversight by an installer is thought to be inadequate tightening of couplings, connectors, locknuts, etc.

At the request of Carlon, Factor Mutual Research conducted a study to determine whether the metal raceways, PROPERLY INSTALLED, might lead to fire and explosion hazards under simulated ground fault conditions. The report, "Tests of Wiring in Electrical Conduits Under Ground and Arcing Fault Conditions Simulating Fire and Explosive Hazards," by D. M. Karydas and J. L. Chaffee, FMRC J.I. OP2R3.RU, October, 1987, states the following observations and conclusions:

NOTE: Supporting Material Available For Review At NFPA Headquarters.

"TEST REMARKS AND OBSERVATIONS

High-Current Tests

1. Thirty-eight tests were conducted under various conditions of fault current on thirteen conduit configurations including metallic and nonmetallic conduits and various types of fittings.

2. The majority of the tests where conduit was used as grounding device demonstrated electrical flashing at points of discontinuity, including conduit couplings, end-box connections and conduit bonding (i.e., cable to conduit and cable to end-box connections). Hot spots and flashing in the form of showers of sparks were observed in all types of discontinuities (normally tight couplings, loose couplings, end-box connection tight bonding). In some cases, conduit fittings were ignited and burned, while power was applied (e.g., Test 6). In other cases, (as in Test 22) sustained burning of cable conduit material occurred.

3. In all tests where conduits were used as cable protective-only devices and an arcing ground fault was sustained in the conduit, the conduit walls were penetrated and severe flashing in the form of showers of sparks occurred. No sustained fire was observed involving conduit material. In some cases, combustible material (fabric) located away from the point of the arcing fault (in one case as far as 20 ft away, Test 36) was set on fire by projectiles of molten metal. Plastic conduits were deformed by the heat release at the fault (Test 24).

4. Combustible mixtures encapsulating conduit points of discontinuity were ignited by sparks at the discontinuities and exploded. In one case, Test 16, no sparks were observed and the combustible gas was not ignited. Combustible gas mixtures were either controlled (10.5% methane-air mixture), as in Tests 16, 17, 23 or uncontrolled (pyrolysis gaseous products of cable insulation), as in Test 29.

5. In a "small" spark at a conduit coupling (Test 15, 3000 amps of fault current on heavy wall galvanized conduit, with threadless setscrew couplings), the estimated thermal power was of the order of 30 kW for approximately 2 cycles (30 msec). The temperature rise of the coupling in the first 30 sec after the arcing was 160 degree C.

6. A consistently hazardous discontinuity on a conduit system was the endplate termination where metal conduit was connected to a simulated electrical box. Both the locknut-washer system, bonding the conduit to the box, and the simulated ground lug connected arced, overheated, melted and in many cases burned. In Tests 1 through 13 this phenomenon was predominant, causing the termination of the tests. In the rest of the tests, the end plate termination was removed.

Low-Current Tests

1. Fourteen tests were conducted involving metal and plastic conduits. In the case of metal conduits, self-sustained arcing of variable duration (a few seconds up to almost two hours) between the "phase" and the "grounded" conduit was observed. In the case of the plastic conduit, attempts to sustain an arcing fault between the "phase" and a dedicated grounded conductor within the conduit were not successful.

2. Sustained arcing faults of significant duration (see Table I-1, Appendix I) were mainly observed in tests involving heavy galvanized steel conduits and electrometallic tubing (EMT). Initial arcs within aluminum or IMC conduits became "welded" short circuits within a very short time.

3. The external surface temperature of the conduit at the point of the self-sustained internal arcing under the conditions of Test 9 (arc duration 56 min. 15 sec) reached an equilibrium of approximately 520 degree F (271 degree C), with a maximum of 535 degree F (280 degree C), after approximately 25 minutes. This is less than the spontaneous ignition temperature for most combustible materials. Under different conditions, e.g., conduit within confined wall space or through floor penetration, dust accumulation on its surface, etc., this temperature may rise to higher equilibrium levels.

The power of the arc, in the same test, was estimated at 27.2 watts. The surface of the conduit directly involved in the arcing was estimated at 71.7 10⁻⁹m². The heat flux per unit surface was therefore estimated at 380 10³ kW/m². The total

energy release under the condition of Test 9 was 91.8 kJ or 1.28×10^9 kJ/m². These flux and energy figures represent an estimate only reflecting a possible degree of uncertainty of two orders of magnitude. The internal surface of the conduit at the hot spot area indicated pitting, due to electrical arcing.

4. No ignition was observed of the 10.5% per volume methane-air mixture encapsulating externally the metal conduit under the conditions of Test 13. This test was interrupted by the operator after a total duration of approximately 2 hours.

CONCLUSIONS

High-Current Tests

1. It was demonstrated that under ground fault conditions, metal conduit discontinuities release high thermal energy, visually manifested as showers of sparks, that is sufficient to ignite directly flammable gases, or pyrolyze and melt, or even burn metallic parts (conduit fittings, etc).

2. It was also demonstrated that under internal high-current arcing conditions, both plastic and metallic conduits suffer external wall rupture and the arcing fault releases high thermal energy to the ambient; molten metallic substance may ignite flammable material in the vicinity or at a distance from the immediate electrical fault area. No sustained fire involving conduit material itself was observed under these conditions.

*The dimensions of the hot spot were taken from the thermograph of Test 9 on page 12. The accuracy of the measurements depends on the resolution of the thermal scanner and other instrumentation involved. Therefore, reported figures can only be considered as rough estimates only.

Low-Current Tests

1. It was demonstrated that a self-sustained arcing fault may exist for long periods of time (exceeding 2 hours) between phase and grounded metal conduit; under low current conditions (20 amps, 120 volts).

2. If the external surface of the conduit is exposed to air at ambient temperature (70 degree F (21 degree C)) temperature of the external metal conduit surface may reach 520 degree F (271 degree C). Although this temperature is not sufficiently high to ignite most combustible material, under different heat transfer conditions, higher conduit surface temperatures may be achieved. More testing with combustible construction material is needed to evaluate fire hazard of conduit in wall enclosures or similar situations where restricted heat transfer conditions from the conduit surface occur."

Based on this Factory Mutual study, and actual fire loss records, it is apparent that a separate equipment grounding conductor is required in all types of metal raceways and cables in order to provide a safe, effective path for ground fault current.

PANEL ACTION: Reject.

PANEL COMMENT: Proposal would eliminate all raceways as grounding conductors. This would penalize both the good as well as the mediocre installations of wire/cable in conduit. It fails to take into account that if an equipment grounding conductor is in conduit, as recommended, that similar arcing can occur if the careless installer fails to securely attach each end of the equipment grounding conductor which is not visible after installation.

It should be recognized that the NEC is a minimum standard for safety. There is nothing in the Code that would prohibit installation with an internal equipment grounding conductor as proposed; as a matter of fact the latter is a recognized equipment grounding conductor in the NEC.

There are large industrial users whose installation specification go beyond the NEC such as requiring thread-type, rather than threadless, conduit connections; an internal equipment grounding conductor in hazardous (classified) Class I, Division 1 installation, also where fault levels are unusually high; rigid aluminum conduit with threaded connections pulled up very tight (galled connection). Additional

safety techniques for flexible and liquidtight conduit connections. Some users actually test the metal conduit system using a low-voltage current on a deenergized circuit from the load back to the source so as to test the conduit capabilities as an equipment grounding conductor.

Field experience, where the metal raceway system is properly selected and installed with tight (threaded) connections, etc. has been good when based on these long-standing Code rules utilizing the metal raceway as the equipment grounding conductor.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1236, 2571

5- 211 - (250-91(b), Exception No. 3-(New)): Reject
SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I. (1236)

M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (2571)

RECOMMENDATION: Add:

Metal raceways installed underground and metal raceways installed in a slab at or below grade level shall not be permitted as a grounding means. A copper or other corrosion-resistant conductor or an aluminum conductor with insulation suitable for wet locations shall be provided in the circuit where an equipment grounding conductor is required.

(Renumber present Ex. No. 3 as No. 4)

SUBSTANTIATION: Once you establish a solidly grounded system, one of the worst conditions you can encounter is to have a poor or ineffective grounding path. This principle underlies most of the rules in Article 250. We constantly see underground conduits that are rotted away to the point of ineffectiveness or which are completely gone.

The primary objection to this proposal would seem to be that the Code already takes care of the problem by requiring that soil conditions and corrosion protection be taken into account. Our response to this is two fold. First, that sounds fine, but our experience is that we still have the problem. Second, we are not soil testers. Expecting us to know when the soil is too acid, or whatever, for the conduit is not reasonable. It asks too much.

The Canadian Electrical Code already contains a requirement for an extra grounding conductor in underground conduits. We do not know how that rule is worded. But, if the panel accepts this proposal, perhaps the Canadian panel member would provide a copy of his rule so that the phrasing could be compared and made use of.

PANEL ACTION: Reject.

PANEL COMMENT: The solution proposed to the problem is unfair to many parts of the U.S.A. where soil or electrolyte conditions do not warrant these measures. On the other hand, the proposed solution will fall short of providing adequate corrosion protection under more severe corrosion conditions. "Grounding where corrosion protection is required" is discussed in an Article by the same name in IEEE Transactions on Industry Applications, Volume IA-18, No. 6 November/December 1982, pp 600-607, as well as providing a list of several additional references on corrosion. See also "Grounding in Corrosive Areas," May 1983, EC&M, pp 65-67.

Limited rules on corrosion are referenced in the NEC Index under the subject "Protection, corrosion; note particularly Section 300-6.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Haman, Toomer.

EXPLANATION OF VOTE:

HAMAN: Experience in North Dakota has been much the same as what is described in the proposers substantiation. In a short time the metal conduit rusts and very often after a year or more, is completely destroyed by rust. I agree with the panel that this is not always the case, but the fact that it does occur in many geographic locations, would, I believe, justify the requirement. In colder climates,

condensation will gather in the raceway, freeze, splitting the conduit. This also adds to the problem by leaving an unprotected area for corrosion to start. We have samples of metal conduit that has been completely rusted off in less than two years. This requirement, if adopted, would also insure grounding continuity caused by poor workmanship that can not always be detected by the inspector and if it is detected, is difficult to correct after the installation is complete.

TOOMER: Same as Proposal 5-129.

Log # 1637

5- 212 - (250-91(b), Exception No. 4-(New)): Reject

SUBMITTER: Joseph Misrahi, Metropolitan Transit Authority of Harris County

RECOMMENDATION: Add Exception No. 4:

Bare copper grounding conductor shall not be permitted in metallic conduits in wet locations.

SUBSTANTIATION: To prevent electrolytic corrosion between dissimilar metals in the presence of water, especially in underground locations where it is more likely that water gets into a conduit and stays in it.

PANEL ACTION: Reject.

PANEL COMMENT: Proposal does not provide any substantiation to support the change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1408

5- 213 - (250-91(b)(5)): Reject

SUBMITTER: Donald A. Ganiere, Ottawa, IL

RECOMMENDATION: Delete "(5) Flexible metal conduit where both the conduit and fittings are listed for grounding".

Renumber remainder of section.

SUBSTANTIATION: Flexible metal conduit should be treated the same as flexible metallic tubing and liquidtight flexible metal conduit. Do to the severe restrictions placed on the use of these two items as equipment grounding conductors they are listed in the exception only. The restrictions on flexible metal conduit are the same as those for flexible metallic tubing and therefore flexible metal conduit should only be listed in the exception.

PANEL ACTION: Reject.

PANEL COMMENT: Listed flexible metal conduit and fittings are available.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1520

5- 214 - (250-92(b)): Reject

SUBMITTER: R. P. O'Riley, Innovative Education, Inc.
RECOMMENDATION: Existing - "Metal enclosures that are not physically continuous from cabinet or equipment to the grounding electrode shall be made electrically continuous by bonding each end to the grounding conductor."

Add - "This bonding jumper shall be the same size as the grounding electrode conductor."

SUBSTANTIATION: The Code requires the bonding but gives no indication as how to size the bonding jumper. While attending Code seminars, I have heard three interpretations.

1 - Any size conductor will do just so it is bonded.

2 - It is considered on the line side of the service so the 12 1/2% rule applies. This could make it larger than the grounding electrode conductor.

3 - It should be the same size as the grounding electrode conductor.

PANEL ACTION: Reject.

PANEL COMMENT: The subject of this proposal has been addressed in Section 250-79(c). See Panel Action and Comment for Proposal 5-165.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3188

5- 215 - (250-92(b)): Accept

SUBMITTER: Charles W. Forsberg, The Carlon Company

RECOMMENDATION: 1. Delete last four sentences.

2. Add a new fourth sentence:

"Where a raceway is used as protection for a grounding conductor, the installation shall comply with the requirements of the appropriate raceway article."

SUBSTANTIATION: 1. The present code language does not include nonmetallic raceways.

2. Inclusion of a sentence for each raceway material adds needless verbage to the code.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 642

5- 216 - (250-92(b)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Where open or armored conductors are used they shall be securely fastened to the building construction at intervals of 4-1/2 feet (1.37 m) and within 12 inches (305 mm) of terminations except where fished in existing construction."

SUBSTANTIATION: The proposal would provide support interval requirements for open and armored grounding conductors which is not presently indicated, and allow for fishing conductors in existing construction.

PANEL ACTION: Reject.

PANEL COMMENT: Panel believes subject is adequately covered in Section 250-92(a).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 101

5- 217 - (250-92(c)(3)-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 8 for comment.

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After Section 250-92(c)(2), Add:

"Where circuit conductors are run in flexible metal conduit, flexible metallic tubing or liquid flexible metal conduit as listed in Section 250-91(b), Exception No. 1 and 2, the raceway, with or without equipment grounding conductors or wire(s), shall be capable of safely conducting the fault-current available at the line terminals as indicated in Article 110-10."

SUBSTANTIATION: The practice of installing equipment bonding jumpers inside or outside of metallic raceways/enclosures where the raceway/enclosure is incapable of safely conducting any fault current likely to be imposed. For example, if fault current from a faulted conductor imposed on a flexible metallic raceway or enclosure where an equipment bonding jumper has been installed in/with such raceway or enclosure, that section of raceway enclosure becomes the only conducting path back to the equipment bonding jumper connection point(s); this could produce disastrous results. Such practices: (1) are hazardous; (2) are frequently encountered in the field; and (3) are in violation of the meaning/intent of Article 110-10. This proposal is believed to be a forehanded and judicious endeavor in the interest of safety because of: (1) the reason indicated herein; and (2) the ever-increasing fault current capacity of the public utilities/common grid networks.

PANEL ACTION: Reject.

PANEL COMMENT: No technical substantiation has been provided.

The proposal deals with a requirement for a wiring method and should be placed in Articles 349, 350 and 351.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 102

5- 218 - (250-92(c)(3)-(New)): Reject
 SUBMITTER: Chester Flanagan, San Diego, CA
 RECOMMENDATION: After 250-92(c), add the following:
 "Where isolated equipment grounding conductors are installed, they shall be connected in accordance with Section 250-74, Exception No. 4."
 SUBSTANTIATION: Same as Proposal 5-95.
 PANEL ACTION: Reject.
 PANEL COMMENT: The Panel believes that the direct reference is not necessary, and is easily found in the index.
 VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1468

5- 219 - (Table 250-94): Accept
 SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association
 RECOMMENDATION: Add a new footnote ahead of the present footnote to Table 250-94 as follows:
 "Where multiple sets of service-entrance conductors are used as permitted in Section 230-40 Exception No. 2, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set."
 SUBSTANTIATION: The present rules do not cover the sizing of the grounding electrode conductor where multiple sets of service-entrance conductors are used and leave in doubt the size of the GEC covered in Section 250-91(a) Exception No. 2.
 PANEL ACTION: Accept.
 VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1909

5- 220 - (Table 250-94): Accept
 SUBMITTER: Raymond P. Pelletier, City of Auburn, ME
 RECOMMENDATION: Replace 0 designation with 1/0.
 SUBSTANTIATION: To correlate with other 1/0 designations.
 PANEL ACTION: Accept.
 VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1987

5- 221 - (Table 250-94): Reject
 Secretary's Note: See Secretary's Note on Proposal 5-70.
 SUBMITTER: James M. Daly, The Okonite Company
 RECOMMENDATION: Change all occurrences of "MCM" to "kcmil" in the Table.
 SUBSTANTIATION: Same as Proposal 5-70.
 PANEL ACTION: Reject.
 PANEL COMMENT: See Panel Comment for Proposal 5-70.
 VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 103

5- 222 - (250-95): Reject
 SUBMITTER: Chester Flanagan, San Diego, CA
 RECOMMENDATION: Delete period at the end of the third paragraph and add:
 "or equivalent circular mil area for parallel conductors."
 SUBSTANTIATION: In the interest of safety, this change is needed to provide a sizing reference for equipment grounding conductors for safety.
 PANEL ACTION: Reject.
 PANEL COMMENT: The present wording adequately conveys the submitter's intent.
 VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 104

5- 223 - (250-95): Reject
 SUBMITTER: Chester Flanagan, San Diego, CA
 RECOMMENDATION: In the second paragraph between the words: "parallel in" and "multiple raceways", add: "single or".
 Amend first line only in the second sentence as indicated:
 The/"each parallel equipment, grounding conductor
 In the last line of the second paragraph, change the word: "raceway" to read: "raceway(s)".
 SUBSTANTIATION: This section does not contain any/ample equipment grounding conductor sizing guidelines in cases where paralleled conductor are installed in single raceway and since; this is a widely used practice/procedure. It should be noted that because of the need for flexibility in installation, equipment grounding conductors may be paralleled in a single raceway.
 PANEL ACTION: Reject.
 PANEL COMMENT: There is no justification to require parallel grounding conductors where circuit conductors are paralleled in the same raceway, but it is not prohibited.
 VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 643

5- 224 - (250-95): Accept
 Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 11 for information.
 SUBMITTER: Dan Leaf, Westlake Village, CA
 RECOMMENDATION: Add additional paragraph:
 "Where the overcurrent device consists of an instantaneous trip circuit breaker or a motor short-circuit protector, the equipment grounding conductor shall not be smaller than the circuit conductors."
 SUBSTANTIATION: Where these devices are used only short-circuit and ground-fault protection is provided. Common settings of instantaneous trip circuit breakers of 7 to 13 times the load current and MSCP devices which operate at 8 to 10 times the load current provide a conductor overcurrent protection ratio which differs from thermal-magnetic devices and standard fuses. The proposal would provide a different requirement for sizing the grounding conductor since ratings for these devices do not reflect ampere ratings.
 PANEL ACTION: Accept
 PANEL COMMENT: The Panel recognizes this is a safe approach, but may be too conservative and therefore requests the Correlating Committee to address the problem, also see Proposal 5-235.
 VOTE ON PANEL ACTION:
 AFFIRMATIVE: 8
 NEGATIVE: Eldridge, McIntosh, Reardon.
 EXPLANATION OF VOTE:

ELDRIDGE: This proposal is not correct, the NEC does not allow instantaneous circuit breakers alone as short circuit protection, see Article 430-52.

MCINTOSH: I believe the proposal is in conflict with Section 430-52 and should be rejected.

REARDON: The proposal fails to consider the conductor protection provided by motor overload devices. Motor short circuit protectors and instantaneous circuit breakers are permitted to be used only if they are a part of a controller assembly that includes overload protection (Article 430-52).

I see no problem in using Table 250-95 with the ampere rating of the overload device used as the basis for selecting the equipment grounding conductor size. The overload device certainly qualifies as an "automatic overcurrent device" as referred to in the left-hand column of Table 250-95.

Log # 2831

5- 225 - (250-95): Reject

SUBMITTER: David A. Mazur, U.S. Electrical Motors Div., Emerson Elec. Co.

RECOMMENDATION: Revised text:

250-95. Size of Equipment Grounding Conductors, third paragraph ("When conductors . . . mil area"): Add sentence: "When the equipment grounding conductor has to be so proportioned in size, the adequacy of the equipment provided grounding provision (the means for attachment of a termination and, if supplied, the termination itself) shall be re-evaluated."

SUBSTANTIATION: For a motor manufacturer to provide an adequate grounding provision, he needs to know the expected size of the equipment grounding conductor to be used in the installation. 250-95 proportions this size to the voltage drop of the circuit. By the current wording of the NEC, it is impossible for a motor manufacturer to anticipate the maximum size ground conductor where the ultimate voltage drop on the circuit is not known. Certainly, for our markets, I am not aware of ever being provided this information.

PANEL ACTION: Reject.

PANEL COMMENT: The problem cited is an equipment and design problem. There is hardware such as reducing lugs to solve the problem.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2339

5- 226 - (250-95, Exception-(New)): Reject

SUBMITTER: Daniel W. VonBerg, Illinois Department of Conservation

RECOMMENDATION: Add the following exception to 250-95, Exception No. 4-(New):

Exception: When adjusting current conductors in size to compensate for voltage drop; equipment grounding conductors, where used, may be sized to give a current conductor plus equipment grounding conductor loop resistance equal to or less than the circuit's Voltage to ground divided by three times the rating or setting of the overcurrent device protecting the circuit.

SUBSTANTIATION: This exception offers an alternate, result oriented, and more meaningful method of calculating green wire sizes than that called for in the third paragraph of Section 250-95. In many ways this method is superior for the below reasons: A) It guarantees tripping or blowing the protection device in a timely manner, even if 210-19's suggested 3 or 5% regulation is not accepted by the designer - this is especially critical on long runs; B) It allows the designer to juggle both Current and Green wire sizes between various circuit segments to maximize system safety; C) It eliminates the inequalities caused by the lack of smooth transition in Tables 250-95, and those of 310-X; D) It simplifies computer calculation; and E) When used as a design criteria, it gives construction crews and inspectors a value to test against using easy Hot Circuit Loop Impedance measurements to: 1) Test Fault Current continuity and 2) Make Hot and Green Wire size and length verifications.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The NEC is not a design manual, see Section 90-1(c). Section 90-1(b) states in part that the NEC is a minimum standard. Designers have always had the option of going beyond the requirements of the NEC.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2995

5- 227 - (250-95, Exception No. 1): Reject

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: The words "a listed flexible cord assembly" should be deleted and replaced by the words "listed flexible cord".

SUBSTANTIATION: It is unrealistic, and never enforced, to disallow all field constructed cord assemblies that contain grounding conductors smaller than #14. Grounding plugs and cord bodies are made up in the field all the time from listed materials, but certainly they are never then submitted for a listing as the finished assembly.

PANEL ACTION: Reject.

PANEL COMMENT: Acceptance would be in conflict with Section 240-4.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 228 - (250-95, Exception No. 1): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for information.

SUBMITTER: CMP 5

RECOMMENDATION: Revise 250-95, Exception No. 1 as follows:

Exception No. 1: An equipment grounding conductor not smaller than No. 18 copper and not smaller than the circuit conductors and part of fixture wires or cords in accordance with Section 240-4.

SUBSTANTIATION: To correlate with Section 240-4.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 644

5- 229 - (250-95, Exception No. 4-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception No. 4: Where cable tray or cablebus framework is used as an equipment grounding conductor as provided in Sections 318-6 and 365-2."

SUBSTANTIATION: These equipment grounding conductors also appear to be exceptions to this section.

PANEL ACTION: Reject.

PANEL COMMENT: Adequately covered by Exception No. 3.

See Panel Action and Comment on Proposal 5-206.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2349

5- 230 - (250-95, Exception No. 4-(New)): Reject

SUBMITTER: Frank Martucci, Fort Lee, NJ

RECOMMENDATION: New text:

Exception #4: Redundant grounding by means of 2 equipment grounding conductors not smaller than #18 shall be permitted.

SUBSTANTIATION: Over 7000 electrocutions occur each year due to loss of grounding, poor grounding, or improper wiring. Grounding redundancy using two grounding conductors will:

1. Restore the grounding redundancy violated by exceptions #1 and #2 in section 250-95, without the hardships to manufacturers that prompted them.

2. Prevent electrocutions due to any combination of improper wiring errors.

3. Minimize normal leakage line drop, providing zero-potential grounding to patients sensitive to micro-shock in all areas of the hospital. As of now, only permitted, not mandated, in the patient's bed location. Patients having electrical equipment inserted into new or existing openings of their bodies are in dire need of this protection.

4. Provide 2X the current carrying capacity of the circuit conductors and one half the resistance, necessary to maintain grounding integrity conducting 10,000 spike amperes required to trip circuit breakers.

5. Protect the do-it-yourselfer from electrocution when he attempts to install a plug or an extension cord with unmarked conductors (see sample cord).

PANEL ACTION: Reject.

PANEL COMMENT: Redundant grounding is not prohibited.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1694

5- 231 - (250-95, FPN-(New)): Reject
SUBMITTER: Terry Tollefsbol, Tomball, TX
RECOMMENDATION: Add FPN to end of Section 250-95
 (FPN) Refer to wire and cable manufacturer's short circuit withstand data to determine capability of Equipment Grounding Conductors during short circuit conditions.
SUBSTANTIATION: Minimum sizes of equipment grounding conductors shown in Table 250-95 may be inadequate for systems with substantial available short circuit currents. For this reason, the reader should be notified to refer to the wire and cable manufacturer's literature to determine the short circuit suitability of the desired cable.
PANEL ACTION: Reject.
PANEL COMMENT: The first sentence of Section 250-95 recognizes Table 250-95 contains minimum sizes. A competent designer should verify that these numbers are adequate, or increase them where required. This is design information.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 645

5- 232 - (Table 250-95): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add double asterisk note:
 "Continuous current-carrying capacity characteristics of over 600 volt overcurrent protective devices shall be considered in determining the rating in the first column which shall be used."
SUBSTANTIATION: Ampacity values for opening high-voltage circuits may be 6 times the conductor ampacity rating, and E or R fuse ratings do not equate with amperes.
PANEL ACTION: Reject.
PANEL COMMENT: Submitter has not substantiated that a problem exists.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1910

5- 233 - (Table 250-95): Accept
SUBMITTER: Raymond P. Pelletier, City of Auburn, ME
RECOMMENDATION: Replace 0 designation with 1/0.
SUBSTANTIATION: To correlate with other 1/0 designations.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1988

5- 234 - (Table 250-95): Reject
 Secretary's Note: See Secretary's Note on Proposal 5-70.
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change all occurrences of "MCM" to "kcmil" in the Table.
SUBSTANTIATION: Same as Proposal 5-70.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-70.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3343

5- 235 - (Table 250-95): Reject
 Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 11 for information.
SUBMITTER: S. Zackerman, Cincinnati, OH
RECOMMENDATION: Revise the left-hand column to read as follows, and add indicated footnote:

Rating or Setting of Automatic Overcurrent Device (Rated in Amperes) Ahead of Equipment, Conduit etc. Not Exceeding (Amperes)	Range of Motor Full-Load Current for Motor Circuits Protected Ahead of Equipment Conduit, etc. by Overcurrent Devices not Rated in Amperes† (Amperes Range)
15	6.0 and less
20	6.1 - 8.0
30	8.1 - 12.0
40	12.1 - 16.0
60	16.1 - 24.0
100	24.1 - 40.0
200	41 - 80
300	81 - 120
400	121 - 160
500	161 - 200
600	201 - 240
800	241 - 320
1000	321 - 400
1200	401 - 480
1600	481 - 640
2000	641 - 800
2500	801 - 1000
3000	1001 - 1200
4000	1201 - 1600
5000	1601 - 2000
6000	2001 - 2400

†Motor short-circuit protector or instantaneous trip only circuit breaker (see Section 430-52 and Table 430-152).

SUBSTANTIATION: No procedure presently exists for sizing equipment grounding conductors in circuits protected by overcurrent devices not rated in amperes, i.e., motor circuits protected by motor short-circuit protectors or by instantaneous trip only circuit breakers. Thus it is logical to determine the motor circuit equipment grounding conductor size in such cases from motor full-load current, if some rationale can be established for determining (rough) equivalence between a fairly narrow range of motor full-load currents and the size of ampere-rated overcurrent device that would otherwise correspond to that range.

This proposal merely assumes (and, it is believed, conservatively) that a fairly representative maximum rating of an inverse-time circuit breaker to protect a given motor would be 250 percent of the motor full-load current, and then makes the further assumption that a nonampere-rated protective device applied so as to protect the same motor circuit would protect the same equipment grounding conductor size associated with an inverse-time circuit breaker chosen to protect that motor circuit. For example, a motor circuit for a motor with 100 amperes full-load current could be protected by a 250 amperes maximum inverse-time circuit breaker, calling for a No. 4 AWG copper equipment grounding conductor, and it is assumed that the corresponding maximum allowable selection of motor short-circuit protector or instantaneous trip only circuit breaker would protect the equipment grounding conductor as well as or better than the 250-ampere breaker. Credence is lent to this assumption by considering that the instantaneous trip pickup of the 250-ampere inverse-time breaker would likely be in the range of 1750 amperes to 2500 amperes or higher, whereas an instantaneous trip only breaker for the same motor is constrained to a maximum 1300 amperes (1300 percent) instantaneous trip by Section 430-52, and the current withstandability of the equipment grounding conductor is principally established by the instantaneous trip pickup, for a given ground-fault magnitude.

The situation when comparing fuses is more complicated, but inasmuch as nearly all motor circuits protected by ampere-rated fuses are protected by dual element (time-delay) fuses, use of the analogous 175 percent factor would only result in selection of a smaller equipment grounding conductor, which result this proposal chooses to ignore in the interests of conservatism. Finally, the top of the ampere range in the proposed new column is determined merely by dividing the ampere figure in the existing column by 2.5 (i.e., 250 percent).

Admittedly, this rationale is not very scientific, but it seems reasonable and conservative, since it is well-established that properly chosen motor short-circuit protectors and instantaneous trip only circuit breakers provide better ground-fault protection to motor circuits than do inverse-time circuit breakers and dual element (time-delay) fuses chosen to the maximum allowable. Further, it seems futile to try to pin down equipment grounding conductor sizes with any greater degree of exactitude when it is clear that the present rationale for sizing equipment grounding conductors is deeply flawed, i.e., it ignores the differences between the time-current characteristics of inverse-time circuit breakers and dual-element (time-delay) and nontime-delay fuses, and, worse yet, it ignores the huge range of possible ground-fault current magnitudes that any given wire size could experience anywhere, any time.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes the intent is achieved by the Panel Action and comment on Proposal 5-224.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 646

5- 236 - (250-97): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Delete.

SUBSTANTIATION: This is already covered in Section 600-5 which is in the proper article for special equipment of this type.

PANEL ACTION: Reject.

PANEL COMMENT: There is an additional requirement in Section 250-97 that is not in Section 600-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 105

5- 237 - (250-99(a)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in the exception as indicated:

... (which preclude energization) "where interconnection is impossible" without grounding continuity.

SUBSTANTIATION: The use of regular "code" language will provide a better expression of meaning and intent.

PANEL ACTION: Reject.

PANEL COMMENT: There is not adequate support to warrant the change of "preclude" to "impossible."

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1828

5- 238 - (250-112): Accept

SUBMITTER: John E. West, Cody, Wyoming

RECOMMENDATION: Add:

"... effective bonding shall be provided around insulated joints and sections and around any equipment that is likely to be disconnected for repairs or replacement." Bonding conductors shall be of sufficient length to permit removal of such equipment while retaining the integrity of the bond.

SUBSTANTIATION: Many water utility employees have reported bonding jumpers around water meters and valves so short that they must be removed in order to disconnect or replace the equipment. There have also been cases of electrical shock reported when this was

done. This is a dangerous practice that carries the potential for serious injury or even a fatal electrical shock. Inasmuch as most of these people do not possess the electrical knowledge to realize what they are getting into, it should be incumbent upon the electrician to install jumpers long enough to provide adequate space to work on this equipment without removing the bonding jumpers to do it.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Toomer.

EXPLANATION OF VOTE:

TOOMER: It will not be known at the time of installation what length would be long enough.

Log # 2374

5- 239 - (250-112): Reject

SUBMITTER: Tim Pinnick, City of Lawrence, KS

RECOMMENDATION: Add new last sentence to paragraph.

The location of an accessible connection of a grounding electrode conductor to a grounding electrode shall be permanently stated on a plaque or directory on the service equipment.

SUBSTANTIATION: The Code requires specific types of grounding electrode connections to be accessible per Section 250-112, logically these locations should be recorded at the time of installation for future reference. The locations are often "lost" after the initial installation because the connections are often made in areas remote from the service equipment which can be above suspended ceilings, behind appliances and other places that are not readily accessible.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel disagrees with the Substantiation that the connection is required to be readily accessible.

No demonstrated need for the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2355

5- 240 - (250-113): Reject

SUBMITTER: Myron N. Daniels, U.S. Navy Shipyard, Pearl Harbor, HI

RECOMMENDATION: Add new sentence:

"Where parts are to be fastened together by screws, the threaded part shall have two or more clean-cut threads engaged. Where the screw does not protrude all the way through the threaded part, the tapered end, the lead end, and the first full thread shall be disregarded in counting the number of threads engaged."

SUBSTANTIATION: Several hundred domestic residences at three military housing areas had metal enclosures bonded as is required by Article 250-79(a)(b). The problem is/was that a course threaded self tapping sheet metal screw was used to fasten a connector lug to the metal enclosure. When hand checked for tightness, by applying slight lateral tension to the bonding jumper wire, these connections readily became loose. Retightening of these screws did not correct this problem. In this inspectors opinion, this type connection constitutes a potential safety hazard, in that the enclosures are not bonded to the grounding system to effect a permanent and effective grounding of these enclosures. Articles 250-72(a)(d) and 250-32 and 33 are example areas of where this problem was found to exist. The method is contrary to the intent of Article 250-113, which is to assure a mechanically tight connection to provide good reliable electrical continuity.

"Screws", as noted in Article 250-79 are not a UL listed item. It would be prudent and appropriate to add this new text to Article 250-113 as new text, or as a Fine Print Note. This would then assure that the intent of Article 250-113, and other related articles noted previously would be properly supported in their requiring a pressure type connection.

This author has drawn some of the language for the text from UL publication 67, paragraph 7.15. UL 67 does not apply to Article 250-113, but was the only authoritative source that referenced screws, which was the root of this problem.

See also UL 467, 1.8 and Table 1.1. This should be a FPN.

Many electrical construction contractors, installers and inspectors very rarely have access to UL publications, and even if they do, most do not read them. Consequently they do not understand the full significance of the U.L. publication as an integral part of code recommendation and enforcement of using tested proven products to ensure safety, when approved by the authority having jurisdiction.

Additional Justification:

The Code making panel may not be aware of the problems associated with U.S. Navy, government, contract administration. One big problem is that: We cannot enforce "Intent." This means, each and every item must be spelled out within the specifications, or shown in details upon the drawings. This is an overwhelming task for the designers.

Most US Navy specifications state in part "Electrical Installation shall conform to the requirements of NFPA 70, and to the requirements specified herein."

Sounds and reads real good. However, because NFPA 70 does not cover the "screw" or similar type problem whatever it may be, the contractor files a claim against the government stating that the "screw" or whatever was not shown on the drawing, not in the specs, and not in NFPA 70. "Show me where it says I must, or must not use that screw."

The Authority Having Jurisdiction in a civilian municipality can shut down the work or deny utility connection or service till the discrepancies are corrected.

What happens in our type situation is that the unsafe condition exists until the claim is resolved; or by direction the contractor is forced to comply while the claim is pending resolution by the appeals clauses of government contracts.

This uses up many tax dollars, which is a waste.

Therefore; for all of the reasons (condensed) I respectfully request that this proposal be incorporated, into Article 250-113 as stated above; new text, or fine print note.

See last sentence, UL ltr dtd Feb. 6, 85 enclosed/attached.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal addresses a subject that is related to the design and manufacture of the parts used to connect the grounding and bonding jumpers. As such, it is not appropriate as a Code rule, but instead applies to the requirements of the organization that lists the connectors. For example, although the requirements of a qualified listing organization do not specify precisely what type of screws shall be used for this purpose, the requirements do specify that two full, clean-cut threads be provided. Coarse sheet-metal screws do not meet this requirement, and are not acceptable. The present Code rule in Section 250-113 specifies LISTED products (except for exothermic welding). This places the responsibility to require proper designs of connectors, clamps, etc. on the listing organization—not the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 647

5- 241 - (250-114): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add; "or other enclosure" after "boxes", and insert "direct" between "a" and "connection" in paragraph (a).

SUBSTANTIATION: To include enclosures such as switchboards, cabinets, etc., which may not be construed as boxes, and provide specifics such as in Section 384-27.

PANEL ACTION: Reject.

PANEL COMMENT: Adequately covered by Section 250-113. There is no substantiation provided for inserting the word "direct".

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2413

5- 242 - (250-115): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Revise first and second sentence as follows:

The grounding "electrode" conductor shall be connected to the grounding fitting by exothermic welding, listed lugs, listed pressure connectors, listed clamps, or other listed means. Connections depending "solely" on solder shall not be used.

NOTE: Added material in quotations.

SUBSTANTIATION: The sentence should be revised to clarify requirements. It is the grounding electrode conductor rather than the grounding conductor. Connections that are mechanically secured and then soldered should be acceptable.

PANEL ACTION: Reject.

PANEL COMMENT: Inserting the word "solely" implies that soldering is permissible.

It is not permissible to solder a listed connector.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 648

5- 243 - (250-115(a)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add; "copper or copper alloy".

SUBSTANTIATION: This material is permitted in Sections 547-8(b) and 680-22(b); there doesn't appear to be a valid reason to limit it to those articles.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation for the change, since the sections referenced in the substantiation are not applicable.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 910

5- 244 - (250-121, Exception): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: In second line change "less than 1000 volts" to "1000 volts and less, nominal".

SUBSTANTIATION: Same as Proposal 5-54.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Comment for Proposal 5-54.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 911

5- 245 - (250-123): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Revise heading to:

"Cases of Instruments, Meters And Relays in Low-Voltage Systems".

Revise text to:

Instruments, meters, and relays operating with windings or working parts 600 volts or less, nominal to ground and 1000 volts or less, nominal line-to-line shall be grounded as specified in (a), (b), or (c) below.

SUBSTANTIATION: The present text of this section does not correlate with Section 250-124. For instance, instruments operating in systems of over 1000 volts, but at less than 1000 volts to ground are not covered by either section. The revisions correlate both sections with revisions proposed for other parts of the Code.

PANEL ACTION: Accept.

PANEL COMMENT: See Panel Comment for Proposal 5-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 912

5- 246 - (250-124): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
 Correlating Committee
RECOMMENDATION: Revise heading to:
 "Cases of Instruments, Meters And Relays in Medium-
 And High-Voltage Systems".
 Revise text to:
 "Where instruments, meters and relays have
 current-carrying parts exceeding 600 volts, nominal, to
 ground or 1000 volts nominal, line-to-line, the cases
 shall be . . ." (remainder unchanged).
SUBSTANTIATION: Same substantiation as for proposed
 revisions to Section 250-123.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 913

5- 247 - (Article 250, Part M, Title): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
 Correlating Committee
RECOMMENDATION: Revise title as follows:
 M. Grounding of Medium- And High-Voltage Systems.
SUBSTANTIATION: Proposal is to obtain consistency in
 voltage terminology throughout the Code and to
 incorporate recognized industry standards and
 practices. See proposed definitions of low-, medium-
 and high-voltage circuits, equipment and systems
 (Article 100 proposals).
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 914

5- 248 - (250-150): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
 Correlating Committee
RECOMMENDATION: In first line after first word insert
 "medium- and"
SUBSTANTIATION: To correlate with proposed new
 definitions of voltage ranges.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 915

5- 249 - (250-151): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
 Correlating Committee
RECOMMENDATION: Revise to read:
 250-151. Derived Neutral Systems. A system neutral
 derived from a grounding transformer shall be permitted
 to be used for grounding medium- and high-voltage
 systems.
SUBSTANTIATION: To correlate with proposed new
 definitions of voltage ranges.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1140

5- 250 - (250-151(a)(2)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line in the sentence
 as indicated:
 . . . neutral (grounding) "grounded" conductor shall
 be . . .
SUBSTANTIATION: This revision is needed to correct an
 apparent error. The subject matter (Heading) is about
 "grounded" conductors.
PANEL ACTION: Reject.

PANEL COMMENT: The subject is "grounding conductor"
 not "grounded conductor."

See Proposal 5-251.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 251 - (250-152(a)(2)): Accept

SUBMITTER: CMP 5

RECOMMENDATION: Rearrange and rewrite Section 250-152
 as follows:

"250-152. Solidly Grounded Neutral Systems.

(a) Neutral Conductor. The minimum insulation level
 for neutral conductors of solidly grounded systems
 shall be 600 volts.

Exception No. 1: Bare copper conductors shall . . .
 buried portions of feeders.

Exception No. 2: Bare conductors . . . installed
 outdoors.

(FPN) See Section 225-4 . . . or other structure.

(b) Multiple Grounding. The neutral . . . at more
 than one point for:

(1) Services.

(2) Direct buried . . . a bare copper neutral.

(3) Overhead . . . outdoors.

(c) Neutral Grounding Conductor. The neutral
 grounding conductor shall be permitted to be a bare
 conductor if isolated from phase conductors and
 protected from physical damage."

SUBSTANTIATION: Editorial rewrite of this section to
 properly place the requirements for neutral grounding
 conductors.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 916

5- 252 - (250-154): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
 Correlating Committee

RECOMMENDATION: In six places change "high-voltage" to
 "medium- or high-voltage"

SUBSTANTIATION: To correlate with proposed new
 definitions of voltage ranges.

PANEL ACTION: Accept.

PANEL COMMENT: See Panel Comment for Proposal 5-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1141

5- 253 - (250-154): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in the first
 sentence as indicated:

. . . shall comply with (a) through (e) "(f)" . . .

SUBSTANTIATION: Editorial. To correct an apparent
 omission.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 280 — SURGE ARRESTERS

Log # 2216

5- 254 - (280-3): Reject

SUBMITTER: J. K. Daugherty, Flint, MI

RECOMMENDATION: Replace existing Sec. 280-3 as follows:

280-3 Number Required. A surge arrester shall be
 installed in the service equipment of all 120/240 or
 120/208 V single and three-phase services and connected
 to each ungrounded conductor.

SUBSTANTIATION: There are some deaths and several
 fires due to lightning strikes and switching surges on
 the service conductors. These surges cause breakdown
 of insulation systems of electronic equipment which in
 turn create fires. Surge arresters are relatively in
 expensive and easily installed. They are required in
 the Lightning Protection Code, NFPA 78.

PANEL ACTION: Reject.

Log # 912

5- 246 - (250-124): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
Correlating Committee
RECOMMENDATION: Revise heading to:
 "Cases of Instruments, Meters And Relays in Medium-
 And High-Voltage Systems".
 Revise text to:
 "Where instruments, meters and relays have
 current-carrying parts exceeding 600 volts, nominal, to
 ground or 1000 volts nominal, line-to-line, the cases
 shall be . . ." (remainder unchanged).
SUBSTANTIATION: Same substantiation as for proposed
 revisions to Section 250-123.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 913

5- 247 - (Article 250, Part M, Title): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
Correlating Committee
RECOMMENDATION: Revise title as follows:
 M. Grounding of Medium- And High-Voltage Systems.
SUBSTANTIATION: Proposal is to obtain consistency in
 voltage terminology throughout the Code and to
 incorporate recognized industry standards and
 practices. See proposed definitions of low-, medium-
 and high-voltage circuits, equipment and systems
 (Article 100 proposals).
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 914

5- 248 - (250-150): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
Correlating Committee
RECOMMENDATION: In first line after first word insert
 "medium- and"
SUBSTANTIATION: To correlate with proposed new
 definitions of voltage ranges.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 915

5- 249 - (250-151): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
Correlating Committee
RECOMMENDATION: Revise to read:
 250-151. Derived Neutral Systems. A system neutral
 derived from a grounding transformer shall be permitted
 to be used for grounding medium- and high-voltage
 systems.
SUBSTANTIATION: To correlate with proposed new
 definitions of voltage ranges.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1140

5- 250 - (250-151(a)(2)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line in the sentence
 as indicated:
 . . . neutral (grounding) "grounded" conductor shall
 be . . .
SUBSTANTIATION: This revision is needed to correct an
 apparent error. The subject matter (Heading) is about
 "grounded" conductors.
PANEL ACTION: Reject.

PANEL COMMENT: The subject is "grounding conductor"
 not "grounded conductor."

See Proposal 5-251.

VOTE ON PANEL ACTION: Unanimously Affirmative.

5- 251 - (250-152(a)(2)): Accept

SUBMITTER: CMP 5
RECOMMENDATION: Rearrange and rewrite Section 250-152
 as follows:
 "250-152. Solidly Grounded Neutral Systems.
 (a) Neutral Conductor. The minimum insulation level
 for neutral conductors of solidly grounded systems
 shall be 600 volts.
 Exception No. 1: Bare copper conductors shall . . .
 buried portions of feeders.
 Exception No. 2: Bare conductors . . . installed
 outdoors.
 (FPN) See Section 225-4 . . . or other structure.
 (b) Multiple Grounding. The neutral . . . at more
 than one point for:
 (1) Services.
 (2) Direct buried . . . a bare copper neutral.
 (3) Overhead . . . outdoors.
 (c) Neutral Grounding Conductor. The neutral
 grounding conductor shall be permitted to be a bare
 conductor if isolated from phase conductors and
 protected from physical damage."
SUBSTANTIATION: Editorial rewrite of this section to
 properly place the requirements for neutral grounding
 conductors.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 916

5- 252 - (250-154): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC
Correlating Committee
RECOMMENDATION: In six places change "high-voltage" to
 "medium- or high-voltage"
SUBSTANTIATION: To correlate with proposed new
 definitions of voltage ranges.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1141

5- 253 - (250-154): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the first
 sentence as indicated:
 . . . shall comply with (a) through ((e)) "(f)" . . .
SUBSTANTIATION: Editorial. To correct an apparent
 omission.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 280 — SURGE ARRESTERS

Log # 2216

5- 254 - (280-3): Reject
SUBMITTER: J. K. Daugherty, Flint, MI
RECOMMENDATION: Replace existing Sec. 280-3 as follows:
 280-3 Number Required. A surge arrester shall be
 installed in the service equipment of all 120/240 or
 120/208 V single and three-phase services and connected
 to each ungrounded conductor.
SUBSTANTIATION: There are some deaths and several
 fires due to lightning strikes and switching surges on
 the service conductors. These surges cause breakdown
 of insulation systems of electronic equipment which in
 turn create fires. Surge arresters are relatively in
 expensive and easily installed. They are required in
 the Lightning Protection Code, NFPA 78.
PANEL ACTION: Reject.

PANEL COMMENT: It is not the intent to require surge arresters, but they are permitted. Certain areas of the country dictate their use more than others due to storm activity.

The substantiation is not correct that NFPA 78 requires lightning protection.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Skuggevig.

EXPLANATION OF VOTE:

SKUGGEVIG: This proposal should be accepted in principle with the following revisions: (1) An exception should be added to exempt services fed by service laterals which in turn are fed by underground utility power lines. These lines are not as likely to be affected by lightning strokes. (2) The required surge arrester should be listed in order to assure that it is designed and tested for use in this application.

Many electrical fires are reported to have occurred as a result of lightning strokes — some from direct lightning hits, but many as result of high-voltage spikes that are induced on the power lined by nearby lightning strokes which cause insulation failure either in the electrical power distribution system or in utilization equipment in the building. A proper surge arrester installed in the service equipment can reduce the amplitude of these surges and significantly improve the reliability of the electrical insulation in the building and its contents, thereby reducing the incidence of fire.

The National Electrical Code (NFPA-70) and the Lightning Protection Code (NFPA-78) are both approved by the American National Standards Institute (ANSI). As such, they should be consistent. Paragraph 3-20 on page 78-16 of the 1986 Edition of NFPA-78 states "Lightning arresters, protectors, or antenna discharge units shall be installed on electric and telephone service entrances and on radio and television antenna lead-ins." The last sentence in the Panel Comment for this proposal appears to be incorrect.

COMMENT ON VOTE:

TOOMER: The Code should not dictate the use of something for the whole country just because it may be needed in certain areas.

Log # 2517

5- 255 - (280-4, FPN): Accept

SUBMITTER: Frank K. Kitzantides, National Electrical Manufacturers Association

RECOMMENDATION: Change the second fine print note to read:

"(FPN) The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage "and" the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See manufacturer's application rules for selection of the specific arrester to be used at a particular location."

SUBSTANTIATION: Expansion of existing note to include additional parameter on which metal oxide arrester selection is made. Previous note did not include maximum continuous operating voltage as a selection parameter. Slight wording change to better convey intent of this note.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 917

5- 256 - (280-4(a) & (b), Headings): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change heading of (a) and (b) to read as follows:

(a) ON LOW-VOLTAGE CIRCUITS. The rating . . . of application.

(b) ON MEDIUM- AND HIGH-VOLTAGE CIRCUITS - SILICON CARBIDE TYPES. The rating . . . of application.

SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium- and high-voltage circuits, equipment and systems (Article 100 proposals).

PANEL ACTION: Accept.

PANEL COMMENT: See Panel Comment for Proposal 5-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2530

5- 257 - (280-4(b)): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Replace paragraph 280-4(b), including the fine print notes, with the following:

280-4(b) - On circuits 1 kV and over metal oxide surge arresters or silicon carbide surge arresters are the types employed. The rating of the surge arrester selected for a given location shall be determined by analysis of all the factors involved, including (1) arrester type, (2) basic insulation level of equipment to be protected, (3) magnitude and duration of voltage transients affected by phase to ground faults, system grounding techniques, switching surges and other causes.

(FPN): For further information on selection of surge arresters see, "Guide for Application of Valve-Type Surge Arresters for Alternating-Current Systems" (ANSI C62.2 1981) and "Standard for Metal Oxide Surge Arresters for Alternating Current Power Circuits", (ANSI/IEEE C62.11 - 1986).

SUBSTANTIATION: In the present text silicon carbide surge arresters stand out as being the predominant type for arresters rated 1kV and higher. At the present time the metal oxide type of arrester has almost completely taken over for new installations and should be recognized as the leader. Since there are so many installations of silicon carbide surge arresters in use it is deemed desirable to maintain reference to it in the NEC.

The rating and application procedures are different for metal oxide and silicon carbide surge arresters. That is the reason that the two ANSI standard references are included in the fine print note.

PANEL ACTION: Reject.

PANEL COMMENT: The proposed text contains design requirements that are not enforceable.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: McIntosh.

EXPLANATION OF VOTE:

MCINTOSH: I believe the panel action should be "accept in principle" with the following change in wording:

"Replace Section 280-4(b) including the fine print notes with the following: 280-4(b) - On Circuits 1 kV and Over - Silicon Carbide Types and Metal Oxide Types. The rating of silicon carbide and metal oxide arrester types is based on the maximum continuous phase to ground voltage and transient overvoltages.

FPN: Add to the end of the first FPN "and standard for metal oxide surge arresters for alternating current power circuits (ANSI/IEEE C62.11-1987)."

FPN: Modify the second FPN to read: "The selection of a properly rated arrester is based on consideration of the maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase to ground faults, system grounding techniques, switching surges and other causes. See the manufacturer's application rules for the selection of the specific arrester to be used at a particular location."

Log # 65

5- 258 - (280-4(b), FPN No. 2): Reject

SUBMITTER: R. Gerald Irvine, Suffern, NY

RECOMMENDATION: Delete "metal oxide" in second FPN.

SUBSTANTIATION: Presently, as worded, the second FPN indicates that only metal oxide surge arresters are subject to violent destruction due to the "Pressure Relief Rating" of the arrester being exceeded.

Surge arresters have pressure relief ratings, whether metal oxide or other types.
The engineer is responsible for checking the pressure relief rating and duty of metal oxide and other arrester type applications.
PANEL ACTION: Reject.
PANEL COMMENT: The (FPN) is specifically for metal oxide surge arresters.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 918

5- 259 - (280-21): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-21. INSTALLED AT LOW-VOLTAGE SERVICES. Line and . . . service equipment.
SUBSTANTIATION: Same as Proposal 5-256.
PANEL ACTION: Accept
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 919

5- 260 - (280-22, Heading): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-22. INSTALLED ON THE LOAD SIDE OF LOW-VOLTAGE SERVICES. Line and ground . . . during a surge.
SUBSTANTIATION: Same as Proposal 5-54.
PANEL ACTION: Accept
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1142

5- 261 - (280-22): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the second sentence and the first line in the third sentence as indicated:
. . . conductor(s), grounded "(neutral)" conductor, grounding . . .
. . . grounded "(neutral)" conductor and the . . .
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 920

5- 262 - (280-23): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-23. MEDIUM- AND HIGH-VOLTAGE CIRCUITS - SURGE ARRESTER CONDUCTORS. The conductor . . . or aluminum.
SUBSTANTIATION: Same as Proposal 5-54.
PANEL ACTION: Accept
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 921

5- 263 - (280-24): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-24. MEDIUM- AND HIGH-VOLTAGE CIRCUITS - INTERCONNECTIONS. The grounding . . . in (a) or (b) below.
SUBSTANTIATION: Same as Proposal 5-54.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1143

5- 264 - (280-24): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third and fourth lines in the sentence as indicated:
. . . specified in (a) (or) "comma" (b) "or (c)" below:
SUBSTANTIATION: Editorial. To correct and apparent omission.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1144

5- 265 - (280-24(a)(1), (a)(2), (b)(1) and (b)(2)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first lines in the first sentences in (a) (1) and (a) (2) as indicated:
. . . grounded "(neutral)" conductor of the . . .
Amend the fourth line of the first sentence in (b)(1) and the third line of the first sentence in (b)(2) as indicated:
. . . on the grounded "(neutral)" conductor of the . . .
. . . on the grounded "(neutral)" conductor of the . . .
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 243

5- 266 - (280-24(c)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Delete period at the end of the sentence and add as indicated:
"from the authority having jurisdiction".
SUBSTANTIATION: In the interest of safety, this change should be because the phrase "permitted to be made only by special permission" is subject to misinterpretation.
PANEL ACTION: Reject.
PANEL COMMENT: This is presently covered in Section 90-2(c).
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 300 --- WIRING METHODS

Log # 3458

3- 1 - (300-1 and Exception No. 2): Accept in Principle
Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.
It was the action of the Correlating Committee that this proposal be referred to CMP 14 for information.
SUBMITTER: Don C. Jewett, Kalamazoo, MI
RECOMMENDATION: Revised text:
300-1 Scope.
a) All Wiring Installations.
Add:
Exception No. 2: Except as modified by Part D of Article 725 for installations of intrinsically safe systems.
Reorder: Exceptions 2 through 6, as 3 through 7.
SUBSTANTIATION: None.
PANEL ACTION: Accept in Principle.
1. Add new Exception No. 1:
Only those sections referenced in Article 504 shall apply to intrinsically safe systems.
2. Renumber remaining existing exceptions.
PANEL COMMENT: The renumbering to Article 504 is necessary because it is the Panel's understanding that intrinsically safe systems will be incorporated into a new Article 504.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Surge arresters have pressure relief ratings, whether metal oxide or other types.
The engineer is responsible for checking the pressure relief rating and duty of metal oxide and other arrester type applications.
PANEL ACTION: Reject.
PANEL COMMENT: The (FPN) is specifically for metal oxide surge arresters.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 918

5- 259 - (280-21): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-21. INSTALLED AT LOW-VOLTAGE SERVICES. Line and . . . service equipment.
SUBSTANTIATION: Same as Proposal 5-256.
PANEL ACTION: Accept
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 919

5- 260 - (280-22, Heading): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-22. INSTALLED ON THE LOAD SIDE OF LOW-VOLTAGE SERVICES. Line and ground . . . during a surge.
SUBSTANTIATION: Same as Proposal 5-54.
PANEL ACTION: Accept
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1142

5- 261 - (280-22): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third line in the second sentence and the first line in the third sentence as indicated:
. . . conductor(s), grounded "(neutral)" conductor, grounding . . .
. . . grounded "(neutral)" conductor and the . . .
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 920

5- 262 - (280-23): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-23. MEDIUM- AND HIGH-VOLTAGE CIRCUITS - SURGE ARRESTER CONDUCTORS. The conductor . . . or aluminum.
SUBSTANTIATION: Same as Proposal 5-54.
PANEL ACTION: Accept
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 921

5- 263 - (280-24): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change heading to read as follows:
280-24. MEDIUM- AND HIGH-VOLTAGE CIRCUITS - INTERCONNECTIONS. The grounding . . . in (a) or (b) below.
SUBSTANTIATION: Same as Proposal 5-54.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Comment for Proposal 5-5.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1143

5- 264 - (280-24): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the third and fourth lines in the sentence as indicated:
. . . specified in (a) (or) "comma" (b) "or (c)" below:
SUBSTANTIATION: Editorial. To correct and apparent omission.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1144

5- 265 - (280-24(a)(1), (a)(2), (b)(1) and (b)(2)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first lines in the first sentences in (a) (1) and (a) (2) as indicated:
. . . grounded "(neutral)" conductor of the . . .
Amend the fourth line of the first sentence in (b)(1) and the third line of the first sentence in (b)(2) as indicated:
. . . on the grounded "(neutral)" conductor of the . . .
. . . on the grounded "(neutral)" conductor of the . . .
SUBSTANTIATION: Same as Proposal 5-1.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 5-1.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 243

5- 266 - (280-24(c)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Delete period at the end of the sentence and add as indicated:
"from the authority having jurisdiction".
SUBSTANTIATION: In the interest of safety, this change should be because the phrase "permitted to be made only by special permission" is subject to misinterpretation.
PANEL ACTION: Reject.
PANEL COMMENT: This is presently covered in Section 90-2(c).
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 300 --- WIRING METHODS

Log # 3458

3- 1 - (300-1 and Exception No. 2): Accept in Principle
Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.
It was the action of the Correlating Committee that this proposal be referred to CMP 14 for information.
SUBMITTER: Don C. Jewett, Kalamazoo, MI
RECOMMENDATION: Revised text:
300-1 Scope.
a) All Wiring Installations.
Add:
Exception No. 2: Except as modified by Part D of Article 725 for installations of intrinsically safe systems.
Reorder: Exceptions 2 through 6, as 3 through 7.
SUBSTANTIATION: None.
PANEL ACTION: Accept in Principle.
1. Add new Exception No. 1:
Only those sections referenced in Article 504 shall apply to intrinsically safe systems.
2. Renumber remaining existing exceptions.
PANEL COMMENT: The renumbering to Article 504 is necessary because it is the Panel's understanding that intrinsically safe systems will be incorporated into a new Article 504.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1346

3- 2 - (300-1(a), Exception No. 5-(New)): Accept in Principle

Secretary's Note: The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

It was the action of the Correlating Committee that this proposal be referred to CMP 16 for information.

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add a new Exception No. 5 as follows and renumber existing Exception No. 5 to Exception No. 6.

"Exception No. 5: Only those sections referenced in Article 810 shall apply to radio and television equipment."

SUBSTANTIATION: Since Article 810 is in Chapter 8, it is excepted in accordance with Section 90-3. The proposed new exception will make Sections 90-3 and 300-1(a) in agreement.

PANEL ACTION: Accept in Principle.

1. Renumber as Exception No. 6.

2. Renumber existing exceptions (i.e. existing No. 5 becomes Exception No. 7).

PANEL COMMENT: Renumbering is necessary because of the new addition of Exception No. 1 and Panel Action on Proposal 3-1.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1469

16- 1 - (300-1(a), Exception No. 5-(New)): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.

The Correlating Committee advises that Article Scope statements are the responsibility of the Correlating Committee and the Correlating Committee accepts the Panel Action.

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add a new Exception No. 5 as follows and renumber existing Exception No. 5 to Exception No. 6.

"Exception No. 5: Only those sections referenced in Article 810 shall apply to radio and television equipment."

SUBSTANTIATION: Since Article 810 is in Chapter 8, it is excepted in accordance with Section 90-3. The proposed new exception will make Sections 90-3 and 300-1(a) in agreement.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 922

3- 3 - (300-2(a)): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change text to read as follows:

(a) VOLTAGE. Wiring methods . . . shall be used in low-voltage systems where not . . . section of Chapter 3. They shall be permitted for medium- and high-voltage systems where . . . this Code.

SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low, medium and high voltage circuits, equipment and systems. (Article 100 proposals).

PANEL ACTION: Accept in Principle.

Add "extra-low, and" before "low-voltage" in first sentence.

PANEL COMMENT: The addition of extra-low voltage systems is necessary to correlate with the proposed new definition of such systems and is contingent upon the acceptance of that definition.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: I believe the change which adds "extra low" will cause confusion with extra low DC systems at 42.4 volts in Article 725.

PALIVODA: These proposals have been submitted as editorial type changes to obtain consistency in voltage terminology throughout the Code. Although I am in favor of consistency, I do not believe that these

changes are strictly editorial. The substantiation submitted does not address the technical changes that would be required if this new terminology is adapted. Medium voltage cable and high voltage safety signs are two examples where possible confusion could result.

STRANIERO: This proposal has been submitted as an editorial type change. However, the change affects the technical text of the Code. As such, the substantiation is inadequate. The substantiation calls for change for consistencies sake. It does not address any technical change that would arise as a result of the proposals acceptance.

The proposal is not editorial. The substantiation should assess any increased risk and justify it in view of the gain to be achieved.

Log # 847

3- 4 - (300-3(b), Exception): Reject

SUBMITTER: Theodore C. Bushway, Lynn, MA

RECOMMENDATION: Add 380-2, Exception.

SUBSTANTIATION: Avoids a conflict between Code sections in Chapter 3.

PANEL ACTION: Reject.

PANEL COMMENT: Section 380-2 deals with switch connections and has no relation to Section 300-3(b) and therefore there is no conflict.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1145

3- 5 - (300-3(b), Exception to (a) and (b)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first and second lines in the Exception as indicated:

. . . in Sections (250-57(b) comma) 250-79(e) (, 300-5(i), 300-20(a),) "and" 318-8(d) "period" (, 339-3(a)(2).)

SUBSTANTIATION: Sections 250-57(b), 300-20(a) and 339-3(a)(2) are not considered to be "Exceptions" since they are essentially word-for-word repetitions of Section 300-3(b) and, for this reason, they should be deleted.

PANEL ACTION: Reject.

PANEL COMMENT: Since Article 300 Part A provides general requirements for wiring methods, the Panel believes that it is appropriate to refer to the section the submitter proposes to delete.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1911

3- 6 - (300-3(b), Exception to (a) and (b)): Reject

SUBMITTER: Raymond P. Pelletier, City of Auburn, ME

RECOMMENDATION: add to the end of the sentence

. . . 550-11(c)(2), 551-25(c) and 680-22(b).

SUBSTANTIATION: To recognize three additional bonding or grounding methods that may be run as single conductors.

PANEL ACTION: Reject.

PANEL COMMENT: The sections referenced in the proposal apply to bonding conductors. Section 300-3(b) applies to circuit equipment grounding conductors not bonding conductors. The purpose of the two conductors are different. See Article 100 Definitions.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 923

3- 7 - (300-3(c)(1)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting and Mr. Mader's Comment on Vote will be considered by the Panel as a Public Comment.

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change heading and text to read as follows:

(1) LOW VOLTAGE SYSTEMS. Conductors of low-voltage systems shall be permitted . . . or raceway.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept in Principle.

Revise heading and first sentence to read:

Extra-low and Low-voltage Systems. Conductors of extra-low and low-voltage systems alternating and direct current, shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway.

PANEL COMMENT: See Panel Comment for Proposal 3-3.

Also, "alternating and direct current" is retained from original text for clarity.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

COMMENT ON VOTE:

MADER: Panel Action should have ", both" added after the word "systems" and before the word "alternating" in the second line of the proposed text.

Note: My affirmative vote is based upon the assumption that this correction will be made.

Log # 1206

3- 8 - (300-3(c)(1)): Reject

SUBMITTER: Hayssam Safadi, Tucson, AZ

RECOMMENDATION: To add in the end of the paragraph 300-3(c)(1) the following:

"(The 50 volts nominal and less conductors (a.c and d.c) shall be effectively separated from 600 volts nominal or less but more than 50 volts conductors, by a suitable partition, fence, screen, or free distance.)"

SUBSTANTIATION: When conductors of 600 volts or less shall be permitted to occupy the same equipment wiring enclosure, or raceway, it is preferable to take into consideration not only the range of insulation of those conductors which should be at least equal to the maximum nominal circuit voltage rating, but we must also consider the influence of short circuit currents and the possible fire both of which could damage other extra low voltage conductors generally used for sensitive equipment like controls, relays . . .

Therefore it is preferable to protect those extra low voltage conductors (50 volts and less) from low voltage conductors (over 50 volts to 600 volts) with a suitable partition or free distance between them.

PANEL ACTION: Reject.

PANEL COMMENT: Section 300-3(c)(1) generally requires all conductors permitted to occupy the same enclosure, cable, or raceway to be insulated for the maximum voltage of any conductor. Any further restriction for specific circuits should be addressed in the appropriate article. As an example, see existing (FPN).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1836

3- 9 - (300-3(c)(1), Exception No. 2-(New)): Reject

SUBMITTER: Tom Rea, El Segundo, CA

RECOMMENDATION: Add:

Conductors for frequencies of 360 hertz and higher shall not occupy the same pull box, wireway, cable, cable tray or raceway with conductors of different systems. Pull boxes, and raceways for the conductors of 360 hertz and higher systems shall be of non ferrous metal or non ferrous interlocked armor cable.

SUBSTANTIATION: The Aerospace, Aircraft Military & others have standardized 400 hertz systems which are manufactured & tested throughout the nation. These 400 hertz systems have been expanding into the Electronic Computer/Data Processing Equipment area. I have been experiencing a variety of problems when these 400 hertz conductors inadvertently occupy the same pull box and raceway with conductors of other systems. Part of the problem lies with mutual induction, or as the electronic people reference, mutual coupling or cross talk. When the 400 hertz conductors are installed in ferrous conduits another problem arises, heat from

cable reactance with the magnetic materials. I feel these problems should be covered by the N.E.C. instead of the local jurisdiction or in some cases the contractor or local jurisdiction are not aware of the problems that can arise from incorrect installations.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel judges this to be a system design consideration as opposed to a system installation requirement. The submitter has not provided any specific examples of field problems or related hazards associated with existing installations.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 924

3- 10 - (300-3(c)(2)): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change heading and text to read as follows:

(2) MEDIUM- AND HIGH-VOLTAGE SYSTEMS. Conductors of medium- or high-voltage systems shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of a low-voltage system.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept in Principle.

Change "a" to "an" and add "extra-low or" before low-voltage.

PANEL COMMENT: See Panel Comment for Proposal 3-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 925

3- 11 - (300-3(c)(2), FPN): Accept

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change text to read as follows:

(FPN): See Section 300-32, conductors of different systems - medium- and high voltage systems.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Palivoda, Straniero.

EXPLANATION OF VOTE:

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 1873

3- 12 - (300-3(d)-(New)): Reject

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMPs 2, 4 and 6 for information.

SUBMITTER: Abraham Teicher, Westbury, NY

RECOMMENDATION: Add:

300-3 (d) All conductors shall be identified by color. White or grey for the neutral, green for the equipment grounding conductor. Each of the other current carrying conductors shall be of a different color. Conductors used for different voltages shall be different colors. Use of different colored tape at the connection point shall be acceptable.

SUBSTANTIATION: With the continual expansion of industrial plants & the multiplicity of electrical wiring, This has become a SAFETY HAZARD. The ability to identify current carrying conductors in each phase is not a matter of cost but one of safety. Wire of different colors is available in small sizes. Colored tape is available in many colors. Where safety is concerned, cost should not be the reason for not adopting this change.

PANEL ACTION: Reject.

PANEL COMMENT: Article 300 applies to wiring methods. Color coding of conductors should be addressed in those articles applying to conductors, such as Articles 210 (Branch Circuits), 215 (Feeders), 230 (Services), or 310.

The submitter has not provided any substantiation of the degree of hazard involved. No record has been provided of injuries caused by lack of color coding.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2358

3- 13 - (300-4): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: New text:

Where vibration or transmission of noise is possible through metal raceways, it shall be separated by means of a flexible raceway to eliminate such transmission of noise or vibration.

SUBSTANTIATION: To assure adequate continuity between a metal raceway, GRC, IMC, or ENT and to reduce transmission of noise or vibrations to such raceway by rotating machinery or transformers, connection to such motor or transformer would be made with flexible metal conduit (inside) or liquid tight flexible metal conduit or equivalent (outside).

Since seventy or eighty percent of the industry use flexibility in these circumstances and the Code 351-9 Exception 2, 680-25 Exception #2.

501-16B Refers to flexibility it should state in ART. 502-16B 430 or ART 450 that under these conditions of vibration

FLEXIBILITY IS REQUIRED.

PANEL ACTION: Reject.

PANEL COMMENT: Although the Panel agrees that vibration can affect the continuity of raceways, the Panel believes that this proposal is impossible to uniformly enforce. There is no technical substantiation regarding the hazards of transmission of noise or at what levels problems are encountered.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2814

3- 14 - (300-4(a)(1), Exception): Reject

SUBMITTER: Raymond Harper, Seattle, WA

RECOMMENDATION: Add to 300-4(a)(1) exception:

Raceways as covered in article "334", 345, 346, 347, and 348.

NOTE: Added material in quotations.

SUBSTANTIATION: Type MC cable is approved for covered and exposed insulations. Where MC cable is installed in studs or joists in bored holes, to require a steel nail plate over these holes is over protective. MC cable is approved for exposed insulations. Electrical contractors have not informed me of any damage by nails to their MC cable.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that Type MC cable is more likely to be penetrated than the raceways listed in the exception and does not provide sufficient mechanical protection. Section 334-3 indicates that Type MC shall not be subject to physical damage.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2815

3- 15 - (300-4(a)(1), Exception): Reject

SUBMITTER: Raymond Harper, Seattle, WA

RECOMMENDATION: Add to 300-4(a)(1) exception:

Raceways as covered in article "330," 345, 346, 347, and 348.

NOTE: Added material in quotations.

SUBSTANTIATION: Type MC cable is approved for concealed and exposed insulation. When MC cable is installed in studs or joists in bored holes, to require a steel nail plate over these holes is over protective, especially since MC cable is approved for exposed insulations. I have not heard of any MC cable being damaged by nails, when installed in bored holes in studs.

PANEL ACTION: Reject.

PANEL COMMENT: Section 330-11 requires compliance with Section 300-4.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2818

3- 16 - (300-4(b)(1)): Reject

SUBMITTER: Larry E. Fuhrman, Titusville, FL

RECOMMENDATION: Revised text:

(1) In both exposed and concealed locations where non-metallic sheathed cables AND ELECTRICAL NON-METALLIC TUBING" pass through either factory or field punched, cut or drilled slots or holes in metal members. The cable shall be protected by bushings or grommets securely fastened in the opening prior to installation of the cable.

NOTE: Added Material In Quotations.

SUBSTANTIATION: We have experienced failures in both cables and conductors in ENT when the sharp edges of metal framing member cut through the cable or thin section or ENT requirement for grommets for cables have eliminated this failure. But elimination of ENT from requirement has required us to add local amendment to this section. Would like to see NEC address problem areas as to relieve necessity to add local amendment.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal to include electrical nonmetallic tubing in Section 300-4(b)(1) was reviewed in depth by the Panel during consideration of proposed amendments for the 1987 Code. See Comment 3-13 on page 16 of the TCD for the 1987 Code. Based on the UL Fact-Finding Report, submitted for the 1987 Code cycle the added protection by grommets or bushings for electrical nonmetallic tubing is not required. The Panel has not received indication of significant problems from other locations or jurisdictions. Other minor problems reported were due to installation practices of persons not familiar with the product and were resolved through experience.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Fagotti, Palivoda.

EXPLANATION OF VOTE:

FAGOTTI: It may be true that many occurrences of damage to ENT can be eliminated through careful and experienced insulation, however damage to ENT can also occur because of vibration. Vibration occurs in every building and when ENT is laying on a sharp edge damage can occur through the constant rubbing of the ENT on the sharp edge, caused by the vibration of the building.

PALIVODA: The condition of the punch out holes in metal studs can vary considerably from manufacturer to manufacturer or even within a run from one source.

In spite of the fact finding report referenced during the 1987 Code cycle, we continue to get reports of problems caused by this type of construction. If problems are occurring on construction sites, we should do something to correct the problem, not say it doesn't exist.

COMMENT ON VOTE:

GEWAIN: Although it is true, the laboratory evaluation did not result in damage, it should also be clearly understood that there are limitations to any laboratory evaluation of potential problems for conductors in thin-wall, ribbed, pliable tubing. However, the nature of the product may be sufficient to be especially careful because all metal framing through which ENT passes may not have "smooth" punchouts in the web. Many No. 14-20 gage load bearing steel studs in multi-story buildings have one or two small holes in the web in order to meet the design criteria for load bearing steel studs. In that case additional holes are drilled or the existing hole may be made bigger on the job site at the time conductors are installed. The U.L. Fact Finding report did not cover all the typical field conditions. Hopefully we will receive specific experience from Mr. Fuhrman.

3- 17 - (300-4(b)(2)): Accept

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.**RECOMMENDATION:** Change the words "nonmetallic-sheathed cable" in the first line to: "cables". Text would then read in part --Where nails or screws are likely to penetrate cables or electrical nonmetallic tubing,--**SUBSTANTIATION:** The present wording of "nonmetallic-sheathed cable" does not take into account the fact that sheet-rock screws can and do penetrate armored cables and metal-clad cables. The use of AC and MC cables has been forced on us by the restrictive clause in section 336-4(a) which for some reason prohibits the use of Romex above 3 floors. In making inspections every day I talk to electricians who have had sheet-rock screws run through their cables. This presents a serious shock hazard as most of these installations are made in steel studs. Experience has proven that metal-covered cables are not pushed out of the way of sheet-rock screws. These screws are made to penetrate steel studs, some of which are heavier than the armored cables.**PANEL ACTION:** Accept.**VOTE ON PANEL ACTION:**

AFFIRMATIVE: 9

NEGATIVE: Gewain.

EXPLANATION OF VOTE:**GEWAIN:** The Panel action on this proposal is inconsistent with the Panel action and reason on Proposal 3-16. I believe the Panel should understand that web punchouts in steel studs have at least a 1-1/8 inch clearance from the edge of the punchout to the face of the stud to which the wallboard is applied. Second, the screws are expensive therefore specific lengths are used for difference thicknesses of gypsum wallboard (i.e., sheet rock).

For example, using the Underwriters Laboratories, Inc. Fire Resistance Directory as a guide for both fire rated and non fire rated steel stud walls, gypsum wallboard screws are Type S-12 bugle head and for economical reasons 1 inch screws are used for single layers of 1/2 inch or 5/8 inch wallboard and provide a corresponding 5/8 INCH AND 3/4 INCH CLEARANCE between the END OF THE SCREW AND THE NEAREST EDGE OF THE PUNCHOUT WHERE THE EDGE OF CABLES MAY BE LOCATED; 1-5/8 inch screws are used with two layers of 1/2 inch or 5/8 inch wallboard and the clearances are 1/2 INCH AND 3/4 INCH respectively; and 1-7/8 inch screws are used with three layers of 1/2 inch or 5/8 inch wallboard and the clearances are 3/4 INCH AND 1-1/8 INCH respectively. The steel stud provides a safe fixed clearance between the end of the screw and the cable.

Based on the Panel action and reason given for rejection of Proposal 3-16, the Panel should be consistent and also reject this proposal. The submitter has given no specific justification, only what he heard. Based on my examination of this subject I know of no "significant problems from other locations or jurisdictions" (Panel wording in quotes for the rejection of proposal 3-16).

3- 18 - (300-4(d)-(New)): Accept in Principle

SUBMITTER: Richard K. Emmons, Pontiac, MI**RECOMMENDATION:** Article 300, Section 300-4(d)-(New):

(d) Cables and Nonmetallic Raceways Run Parallel to Framing Member. In both exposed and concealed locations, where a cable or nonmetallic raceway-type wiring method is installed parallel to joists, rafters, or framing members, the cable or raceway shall be installed and supported so that the edge of the cable or raceway is not less than 1 1/4 inches, (31.8 mm) from the nearest edge of the framing member.

Exception No. 1: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

SUBSTANTIATION: I believe that cables are subject to physical damage when there is no attempt made to keep the cables away from the edge of framing members. Many inspectors ask for mechanical protection for cables when run on furring strips. Most electricians install cables so as to afford protection from accidental nails by stacking the cables towards the center of the framing member.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept in Principle.

1. Revise proposal to read: "Cables and Raceways Parallel to Framing Members. In both exposed and concealed locations, where a cable or raceway - type wiring method is installed parallel to framing members, such as joists, rafters, or studs, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 1 1/4 inches (31.8 mm) from the nearest edge of the framing member where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1/16 inch (1.59 mm) thick.

Exception No. 1: Raceways as covered in Articles 345, 346, 347, and 348."

2. Renumber proposed Exception No. 1 as Exception No. 2.

PANEL COMMENT: The Panel change satisfies the submitter's intent.

The addition of the protection requirement and Exception No. 1 is to be consistent with Section 300-4(a)(1).

VOTE ON PANEL ACTION: Unanimously Affirmative.**COMMENT ON VOTE:****GEWAIN:** I agree with the panel action because there is no fixed clearance as is the case in proposal 3-17. In addition add the words "and in shallow spaces." This will adequately cover the concern in Proposal 3-19. I object to the Panel Comment for Proposal 3-19. To say that this change is being made to be CONSISTENT with the changes to 300-4(a) and (b) is wrong. The conditions are different. One is running cable through steel studs. This proposal covers cables run parallel to studs, joists, in shallow furred spaces.

3- 19 - (300-4(d)-(New)): Accept in Principle

SUBMITTER: David Shapiro, Safety First Electrical Contracting**RECOMMENDATION:** Section 300-4, proposed addition of text

(d) Cables in shallow spaces

Where permanent finishes are installed over existing surfaces, enough distance shall be maintained that metallic cables are not touching both surfaces at any one point. Non-metallic sheathed cables shall have a minimum of one and one-quarter inch between them and the back of the new finish. Where these clearances are not maintained, the cables shall be protected from penetration by screws or nails by a steel plate or bushing, at least 1/16 inch (1.59 mm) thick, and of appropriate length and width installed to cover the area of the wiring.

SUBSTANTIATION: Metal outlet boxes for NM cable are being sold that are one inch deep. If used with 1/2" drywall, the NM will pretty well be sandwiched between the drywall and minimally furred out masonry walls. With minimal furring out, future nails are as likely to go through the NM as to aim for the furring strips. If NM is not intended for shallow chases generally, it should be protected, by space, from vagrant nails. Unlike BX, it is as likely to be gored by a nail as to be pushed aside. Even BX (by which I mean types AC, MC, and I suppose SNM) will be penetrated if it is targeted at a location where it cannot move; hence 300-4 (a)'s protections. Article 300 seems a more natural location than 333 and 336.**PANEL ACTION:** Accept in Principle.

PANEL COMMENT: See Panel Action on Proposal 3-18. The Panel Action satisfies the submitter's intent relative to nonmetallic-sheathed cable. In addition, the Panel believes that to be consistent with Sections 300-4(a) and (b), metallic cables shall be provided with the same protection.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

GEWAIN: Same as Proposal 3-18.

3- 20 - (300-5(a) and Table 300-5): Accept

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: CMP 3

RECOMMENDATION: 1. Delete definition of "Cover".

2. Replace Table 300-5 with new Table.

3. Delete Exceptions No. 1-8.

SUBSTANTIATION: Table 300-5 is being revised to include both the definition of "Cover" and all of the conditions covered by Exceptions No. 1-8. The purpose of this revision is to clarify how the exceptions apply to the table and to each other. There have been problems where users of the Code would combine exceptions. The proposed table clarifies the minimum required burial depths for all locations and types of wiring methods or circuits by deleting the exceptions and incorporating them into the table. The definition of "Cover" is being placed into the proposed table heading for clarification since the new table will appear on a different page of the Code than Section 300-5(a).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MADER: Heading of proposed Table 300-5 should have the word "the" added in the last line between the words "and" and "top".

Title of second line: In the first line, add the word "Underground" between the words "In" and "Trench".

Table 300-5
Minimum Cover Requirements, Extra-Low and Low-Voltage Circuits, Burial in Inches
(Cover is defined as the shortest distance measured between a point on the top surface of any direct buried conductor, cable, conduit or other raceway and top surface of finished grade, concrete, or similar cover.)

Type of Wiring Method or Circuit					
Location of Wiring Method or Circuit	Direct Burial Cables or Conductors	Rigid Metal Conduit or Intermediate Metal Conduit	Rigid Nonmetallic Conduit Approved for Direct Burial Without Concrete Encasement or Other Approved Raceways	Residential Branch Circuits Rated 120 Volts or less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes	Circuits for Control of Irrigation and Landscape Lighting Limited to extra-low Voltage and Installed with Type UF or in Other Identified Cable or Raceway
All Locations Not Specified Below	24	6	18	12	6
In Trench Below 2 Inch Thick Concrete or Equivalent	18	6	12	6	6
Under a Building	0 (In Raceway Only)	0	0	0 (In Raceway Only)	0 (In Raceway Only)
Under Minimum of 4 Inch Thick Concrete Exterior Slab with no vehicular traffic and the slab extending not less than 6 in. beyond the underground Burial) installation	18	4	4	6 (Direct Burial) 4 (In Raceway)	6 (Direct 4 (In Raceway)
Under Streets, Highways, Roads, Alleys, Driveways, and Parking Lots	24	24	24	24	24
One- and Two-Family Dwelling Driveways and Parking areas	18	18	18	12	18
In or Under Airport Runways Including Adjacent Areas Where Trespassing Prohibited	18	18	18	18	18
In Solid Rock When Covered by Minimum of 2 Inches Concrete Extending Down to Rock	2 (In Raceway Only)	2	2	2 (In Raceway Only)	2 (In Raceway Only)

Note 1. For SI Units: one inch = 25.4 millimeters

Note 2. Raceways approved for burial only when concrete encased shall require concrete envelope not less than 2 inches thick.

Note 3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

Submitted material has been reproduced as received.
See note on Page 1.

Title of sixth line: Add the words "Residential" between the words "Two-Family" and "Dwellings".

STRANIERO: Consistent with NEMA's negative vote on voltage terminology proposals, the table heading and the sixth column heading should be revised to show specific voltages as opposed to voltage terms.

Log # 1866

3- 21 - (300-5, Exception No. 3): Reject

SUBMITTER: Harry W. Burns, Burns Electric, Inc.

RECOMMENDATION: Revise as follows:

EXCEPTION NO. 3: Areas subject to vehicular traffic such as streets, highways, roads and alleys shall have a minimum cover of 24" 610 mm. Residential or commercial driveways and parking areas not covered with at least 3-1/2" of concrete, or equivalent shall have a minimum cover of 18" 457 mm.

SUBSTANTIATION: Reword Exception No. 3 to reduce the cover on commercial and residential parking and drive areas. Exception No. 3 can be, and is applied to any area where a vehicle can be driven or parked, such as in garages, service areas, drive-in stores, car washes and service stations. Parking areas that have 3-1/2" or more of concrete installed with plumbing drains and water lines less than 18" below the surface make this an unreasonable and unnecessary requirement. There is also a problem with applying Exceptions Nos. 1-2-4 and 7.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that commercial driveways and parking areas require the same burial depths as streets, highways, roads, or alleys since they are subjected to the same traffic and potential dig-in hazard. The Panel agrees with reducing the burial depth to 18 inches for residential areas but believes that it should be limited to one- and two-family dwellings. The 18-inch cover is intended to apply regardless of the type of cover.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2709

3- 22 - (300-5, Exception No. 4): Accept in Principle

SUBMITTER: Robert M. Milatovich, Inspection Division, City of Fresno, CA

RECOMMENDATION: Change to read:

Residential branch circuits rated "120 volts" or less and provided with G.F.C.I. overcurrent protection of not more than "20" Amperes shall be permitted with a cover requirement of 12 inches (305 mm).

SUBSTANTIATION: When planting trees, bushes and other vegetation or when installing irrigation plumbing pipes we have encountered problems of having these circuits cut into and a person receiving a shock. By requiring the circuit to be on G.F.C.I. and limiting the voltage and overcurrent device size we will increase the safety in residential installations.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Incorporate submitter's intent into revised Table 300-5 in Panel Proposal 3-20.

This change is necessary because the exceptions are being deleted and incorporated into proposed Table 300-5. See Proposal 3-20.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Jackson.

EXPLANATION OF VOTE:

JACKSON: The proposal is more restrictive than the present Exception 4 in the 1987 Code in three ways. These are:

1. Reduces circuit voltage from 300 to 120 volts.
2. Reduces overcurrent protection from 30 to 20 amperes maximum.
3. Requires a GFCI.

The primary objection is the GFCI requirement. GFCI's may now perform adequately in receptacles with kitchen appliances or outside for temporary use of power tools, but it is doubtful that they will stay closed when supplying a PERMANENT UNDERGROUND CIRCUIT.

When moisture in the soil and circuit lengths up to 75 feet, is taken into account, it is very probable that leakage current it will exceed the five milliamperes trip setting on the GFCI. This is especially true after the wiring insulation has been exposed to moisture for a number of years. The homeowner may then become frustrated with the nuisance tripping and the intentionally bypass the GFCI.

The second objection is in the case of running a 240 volt, 30 ampere circuit to a remote garage to power hand tools and an air conditioner. The subject revision will require direct burial at 24 inches or some other more expensive installation.

Log # 926

3- 23 - (Table 300-5): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change the title of Table 300-5 to read as follows:

"Table 300-5"

"Minimum Cover Requirements for Low-Voltage Circuits"

SUBSTANTIATION: Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium-, and high-voltage circuits, equipment and systems (Article 100 proposals).

The difference in nominal phase-to-phase voltage (1000 versus 600) for direct buried cables is not meaningful. The voltage to ground is not changed, and that voltage is the significant consideration with respect to buried cables. Table 300-5 agrees with Table 710-3(b) in all other respects, for the voltage range 601-1000.

PANEL ACTION: Accept in Principle.

Incorporate "Extra-low and Low-Voltage Circuits" into the heading for Table 300-5.

PANEL COMMENT: See Panel Comment for Proposal 3-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 2360

3- 24 - (Table 300-5, Exception No. 3): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Revised text:

Areas subject to vehicular traffic such as streets, highways, roads, alleys, driveways, and parking lots shall have a minimum cover of 24" (610 mm) unless on residential property and installed in rigid metal conduit or intermediate metal conduit where cover requirement would be reduced to 12 inches.

SUBSTANTIATION: Table 300-5 Exception #6 for airport runways only requires 18 inches, and Exception #7 only requires a lesser depth when covered with 2" of concrete.

I see no real reason when in rigid conduit that on a residential drive that 24 inches be maintained.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel has agreed to reduce the burial depth to 18 inches for one- and two-family dwellings but believes that this minimum depth should be retained to prevent dig-ins or damage in the case of nonpaved driveways.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 707

3- 25 - (300-5(a), Exception No. 1): Reject

Secretary's Note: This was Comment 3-27 on Proposal 3-27 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. It was the action of the Correlating Committee that this comment be considered as an agenda item for CMP 3 for the next revision cycle.

SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Make changes as indicated:
Change "Exception No. 1" to "Exception No. 3".
Change "Exception No. 2" to "Exception No. 1".
Change "Exception No. 3" to "Exception No. 2".
(Place re-numbered exceptions in proper sequence.)
SUBSTANTIATION: These changes are required to conform to the 1984 NEC Manual of Style, Part A, A-2c. (Mandatory exceptions shall precede permissive exceptions.)
PANEL ACTION: Reject.
PANEL COMMENT: This proposal is unnecessary since the exceptions are incorporated into Table 300-5. See Proposal 3-20.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 106
3- 26 - (300-5(a), Exceptions No. 1, 2 and 3): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Re-arrange exceptions as follows:
Existing Change to
Exception No. 1 "Exception No. 3"
Exception No. 2 "Exception No. 1"
Exception No. 3 "Exception No. 2"
Place re-numbered exceptions in proper sequence.
SUBSTANTIATION: These changes are required to conform to the 1984 NEC Style Manual, Part A, A-2c.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 3-25.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 244
3- 27 - (300-5(a), Exceptions No. 1, 2 and 3): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Change Exception No. 1 to Exception No. "3" and renumber Exceptions No. 2 and 3.
SUBSTANTIATION: This change is required to conform to the 1984 NEC Style Manual, Part A, A-2c.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 3-25.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1525
3- 28 - (300-5(a), Exception No. 1): Reject
SUBMITTER: Mark Ode, Scottsdale, AZ
RECOMMENDATION: Revise as follows:
The minimum cover requirements for other than rigid metal conduit and intermediate metal conduit shall be permitted to be reduced 6 inches (152mm) for each 2 inches (50.8mm) of concrete or equivalent in physical protection placed in the trench over the underground installation.
SUBSTANTIATION: This will make consistent article 300-5a. Ext. #1 dealing with low voltage systems (600V or less) with 710-3(b) Exception #1 to the table 710-3b which allows high voltage cable or conduit to be reduced in depth 6" inches for every 2" inches of concrete installed over the installation. If we are allowing over 600 volt installations to be installed this way where is the hazard for under 600 volts. We need this for consistency.
PANEL ACTION: Reject.
PANEL COMMENT: Table 300-5 permits lesser burial depths than proposed by the submitter with the exception of direct-burial cables or conductors. The Panel believes that greater depths are required for these cables or conductors under 600 volts because they normally do not require a metallic sheath, enclosure, or encasement.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1649
3- 29 - (300-5(a), Exception No. 3): Reject
SUBMITTER: Mark N. Shapiro, Farmington Hills, MI
RECOMMENDATION: Revise as follows:
Exception No. 3: Areas subject to vehicular traffic such as streets, highways, roads, alleys, parking lots, "and driveways for other than one and two family dwellings" shall have a minimum cover of 24 inches (610 mm).
Note: Added material in quotations.
SUBSTANTIATION: The 1987 N.E.C. revision that brought all residential driveways into the 24 inch deep requirement seems much too sweeping.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel has reduced the cover requirements for one- and two-family driveways and parking areas. See Panel Comment for Proposal 3-24.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2590
3- 30 - (300-5(a), Exception No. 3 and FPN-(New)): Reject
SUBMITTER: Joseph L. Brown, National Electrical Manufacturers Assoc.
RECOMMENDATION: Change Exception #3 and add FPN to read as follows:
Ex. #3. Areas subject to heavyweight or frequent vehicular traffic shall have a minimum cover of 24 inches (610 mm).
FPN: It is intended that streets, roads, highways, alleys and most commercial parking lots have a 24-inch (610 mm) cover. Residential driveways and parking lots intended primarily for passenger vehicles or infrequent traffic are not intended to be included.
SUBSTANTIATION: The minimum burial depths required for the methods listed in Table 300-5 are adequate when installed in the vehicular traffic areas other than those areas specified in this proposed Exception No. 3. The language of the 1984 NEC perhaps needed clarification and the proposed wording does this.
The 1987 Code change extending this requirement was not substantiated, is unnecessary, and is overly restrictive.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel has reduced the cover requirements for one- and two-family driveways and parking areas. See Panel Comment on Proposal 3-24.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1650
3- 31 - (300-5(b), Exception No. 1 and FPN-(New)): Reject
SUBMITTER: Mark N. Shapiro, Farmington Hills, MI
RECOMMENDATION: Revise as follows:
Exception No. 1: The minimum cover requirements "from Table 300-5" for other than rigid metal conduit and intermediate metal conduit shall be permitted to be reduced . . .
Note: Added material in quotations.
(FPN) The 6 inch reduction in burial depth allowed by this exception is not to be combined with other reductions allowed by some of the other exceptions to this table.
SUBSTANTIATION: Many electricians are under the impression that exceptions 1 and 3 can be combined; resulting in an 18 inch depth requirement.
PANEL ACTION: Reject.
PANEL COMMENT: Section 300-5(b) has no Exception No. 1. The Panel believes that the submitter's concern is for Section 300-5(a), Exception No. 1 and is addressed by incorporating the exceptions into Table 300-5. See Proposal 3-20.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 649

3- 32 - (300-5(c), Exception-(New)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: Type MI and Type MC cable."

SUBSTANTIATION: Since these cables are permitted to be installed underground or embedded within a concrete slab on grade and in concrete above grade, there does not seem to be a safety reason to require the raceway installation. Protection during construction should be no different than if installed in concrete floors on grade or walls or floors above grade. Access for replacement or repair should not be a Code required factor where underground beneath a building since it is not considered for other concrete embedment for these cables or for Type ACL.

PANEL ACTION: Reject.

PANEL COMMENT: Section 330-3(9) requires suitable protection against physical damage for underground runs of Type MI Cable. Not all Type MC cable is suitable for direct burial. See Section 334-3.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1398

3- 33 - (300-5(d)): Reject

SUBMITTER: W. Creighton Schwan, Hayward, CA

RECOMMENDATION: ADD to the first sentence, as follows:

Direct buried conductors and cable emerging from the ground shall be protected by enclosures or raceways extending from the minimum cover distance required by Section 300-5(a) in Table 300-5 below grade to a point at least 8 feet (2.44 m) above finished grade, "or to a box, cabinet, or enclosure at a height less than 8 feet."

RETAIN second sentence and second and third paragraphs as in the '87.

Note: Added material in quotations.

SUBSTANTIATION: It is not uncommon for an underground cable to terminate in an enclosure which is positioned less than 8 feet from grade, in which case it does not make sense to require physical protection to the 8 foot level.

PANEL ACTION: Reject.

PANEL COMMENT: If a cable terminates in an enclosure less than 8 feet there is no need for protection above that level. The submitter has not provided substantiation of problems with the present wording.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1662

3- 34 - (300-5(d)): Accept

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: Delete "in Table 300-5(a)" from Section 300-5(d) first paragraph.

SUBSTANTIATION: The present wording is confusing since 300-5(d) can be applied to the Exceptions to 300-5(a) as well as the distances specified in Table 300-5. Table 300-5 is a part of Section 300-5(a) and need not be referenced.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1908

3- 35 - (300-5(d), Exception-(New)): Reject

SUBMITTER: Raymond P. Pelletier, City of Auburn, ME

RECOMMENDATION: Add

... exception 1. Residential 15 and 20 ampere branch circuits.

SUBSTANTIATION: To accommodate wooden lamp poles shorter than 8 feet, fed with UF. The rule, as written, makes such an installation a Code violation.

PANEL ACTION: Reject.

PANEL COMMENT: If the pole is less than 8 feet in height, protection is only required up to the lamp or fixture enclosure.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1399

3- 36 - (300-5(g) and 300-5(g), FPN): Reject

SUBMITTER: W. Creighton Schwan, Hayward, CA

RECOMMENDATION: REPLACE present text with:

"(g) Raceway Seals. Conduits or raceways from which moisture or gases are likely to be emitted shall be sealed or plugged at either or both ends."

DELETE Fine Print Note

ADD new Fine Print Note to read:

"Suitable material inserted in the raceway to prevent circulation of moisture or vapors will satisfy this requirement, and it need not necessarily be installed in an explosion-proof fitting."

SUBSTANTIATION: Methane gas produced by decomposing material in filled land, and manufactured or natural gas leaking from underground distribution systems may find their way into buildings through raceways. While there may be other paths into the building, the NEC should require that such entry of gases, particularly directly into enclosures where arcing may occur, is not aided by electrical raceways emerging within buildings from underground.

A similar requirement was in the Code for approximately 60 years and was inadvertently omitted when the recommendations of the Technical Subcommittee on Underground Installations were adopted in the 1975 NEC.

Increasing amounts of waste materials are being deposited as land fill, due to environmental restrictions on burning; due to the scarcity of land, this filled land is being used as building sites.

Enclosed are two newspaper accounts of methane gas leaks from a San Francisco newspaper. These are not the result of a nationwide newspaper search, which I am confident would reveal hundreds of such occurrences, but are simply what turned up in my local paper. Sec. 710-3(b)(4) requires that a raceway entering a building "... from an underground system the end within the building shall be sealed with suitable compound so as to prevent the entrance of moisture or gases" The hazard is identical whether the raceway encloses high voltage or low voltage conductors; the gas cannot discriminate.

The suggested FPN is to clarify the point that the sealing required is the same as that required by Section 300-7(a) for raceways exposed to widely different temperatures.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Although the Panel agrees that there may be isolated instances where gases may enter raceways, it does not seem reasonable to expect installers or inspectors to field determine which conduits or raceways may have gases emitted. The proposal requires sealing or plugging at either or both ends. Again, the Panel questions how to determine whether either or both ends require the sealing or plugging.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 691

3- 37 - (300-5(i), Exception No. 2): Reject

Secretary's Note: The subject matter is the responsibility of CMP 3 and the Correlating Committee directs CMP 3 to act on the proposal based on its merits. This action will be considered by the Panel as a Public Comment.

It was the action of the Correlating Committee that this proposal be referred to CMP 13 for comment.

SUBMITTER: Joseph S. Dudor, Midway City, CA

RECOMMENDATION: Revise to read:

Exception No. 2: Isolated phase installations shall be permitted in non-metallic raceways in close proximity where "either (1)" conductors are paralleled as permitted in Section 310-4, "or (2) cables of circuits over 15 kV that are not paralleled," and the conditions of Section 300-20 are met.

Note: Added material in quotations.

SUBSTANTIATION: With the revision of Section 300-3(b), it is apparent that large, high voltage circuits have been ignored by the Panel as being permitted to be run in separate raceways. The following recent example was encountered on a large cogeneration project. The plant in question required two separate 69 kV circuits run underground from the stepdown transformers at the cogeneration plant to the two 69 kV, in-plant distribution substations. The 69 kV cables were lead-sheathed, 1000 MCM, one conductor per phase, each run in a separate 5 inch non-metallic raceway underground. It is a physical impossibility to require such large conductors to be run in the same raceway, and since the cables are in separate raceways, they cannot be considered to be in a common trench, as would be the case if they were directly buried. Thus, there is no way that, given the 1987 NEC wording, this installation could be allowed. However, such an installation as described above is the best that could be engineered for the facility in question. Installation of cables in raceways allows them to be easily replaced should there be a cable failure, and the raceway, enclosed by a concrete envelope, provides the cables with increased mechanical protection over directly buried cables. Article 710 does not have an appropriate section that could include this requirement, and in any event, an appropriate exception in Article 300 would still be required to reference Article 710 if such a section existed. The submitter believes that for circuit voltages of 15 kV or less that the cable sizes available permit the existing wording to cover proper installation methods, but that the increased physical size of cables over 15 kV merit consideration to be run in separate raceways in cases of non-parallel circuit conductors.

PANEL ACTION: Reject.

PANEL COMMENT: This proposal should be addressed in Article 710. Also, there are other conductors available with other covering materials which would allow installation in the same raceway.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3171

3- 38 - (300-5(i), Exception No. 2): Reject
SUBMITTER: K. L. Gebert, Minneapolis, MN
RECOMMENDATION: Delete Section 300-5(i) Exception No. 2.

SUBSTANTIATION: (a) The term "in close proximity" is ambiguous, and under some conditions is difficult, if not impossible, to enforce. In large multiple occupancy buildings, we often see many parallel conductors per phase. It is possible to group these conductors in the same trench but difficult, if not impossible to install in conduit without having considerable spacing between conductors.

(b) The FPN in 215-2 indicates the designer, contractor, and inspector will have to consider the increased values of inductive reactance and impedance which increases the voltage drop. This is of primary concern in areas such as Minnesota where ASHRAE 90-75 mandates the voltage drop recommended by the NEC. Some code experts have indicated that is the responsibility of the designer to determine the impedance of the circuit. I feel this is a cop-out and not realistic because in reality it is the contractor and electrician who make the final physical installation.

(c) Section 300-5(i) Exception 2 also contains the requirement that the conditions of Section 300-20 are met. I am not comfortable with an electrician cutting slots in the metal between the individual holes or installing an insulating wall or otherwise altering a listed piece of equipment. This places a responsibility upon the electrical inspector which he really doesn't need.

PANEL ACTION: Reject.

PANEL COMMENT: Close proximity means they should be immediately adjacent and is adequately clear in this case. The (FPN) in Section 215-2 does not apply to Section 300-5(i). Slots and/or insulating medium is a tried and proven alternative.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1663

3- 39 - (300-8): Accept

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal in reference to the exception. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: Revise Section 300-8 to read:

"Raceways or cable trays containing electric conductors shall not contain any pipe, tube, or equal for steam, water, air, gas, drainage, or any service other than electrical."

SUBSTANTIATION: As written, Section 300-8 prohibits installing electric conductors in a raceway or cable tray with pipes or tubes for other services but does not prohibit installing those pipes or tubes in raceways or cable trays containing electric conductors. Intermixing conductors and tubes in cables has not been a problem. Although this proposal does not address this question, note the Section 300-1(a) Exceptions No 1-5 exempts Article 725, 760, 770, 800 and 820 circuits from Section 300-8. Deleting reference to cables and the Exception also deletes "approved for the purpose" which is not to be used.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Jackson.

EXPLANATION OF VOTE:

JACKSON: It has been a common practice in industrial plants for years to run pneumatic instrument tubing bundles in the same cable tray with electrical cables. The insertion of Section 300-8 in the 1987 Code made it unclear if this is prohibited by the Code. The proposed revision and the deletion of the Exception does nothing to clear up the ambiguity. As a minimum, a FPN should be added to the proposed wording as follows:

(FPN): Section 300-1(a) Exception Nos. 1 thru 5 exempts Articles 725, 760, 770, 800 and 820 from the requirements of Article 300.

The substantiation states that "intermixing of conductors and tubes in cables has not been a problem" so the addition of such a FPN should not be objectionable.

Log # 1902

3- 40 - (300-8): Reject

SUBMITTER: Raymond P. Pelletier, City of Auburn, ME

RECOMMENDATION: Rewrite to include words in quotations.

300-8 INSTALLATION OF CONDUCTORS WITH OTHER SYSTEMS. No electric conductor shall be installed in "or on" any raceway, cable, or cable tray that contains a pipe, tube, or equal for steam, water, air, gas, drainage, or any service other than electrical.

SUBSTANTIATION: This would prohibit the fastening of conductors and cables to other utility conduits.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has not submitted any substantiation of specific problems warranting this change.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 752

3- 41 - (300-8, FPN-(New)): Reject

SUBMITTER: Wyman J. Priestler, III, Newark, DE

RECOMMENDATION: Add the following fine print note:

Section 300-8 does not prohibit the installation of low-voltage signal wiring and instrument air tubing in the same cable tray, as long as they are separated by a partition.

SUBSTANTIATION: This type of installation as been widely used in industrial plants. Section 300-8 does not apply to low-voltage signal wiring because of the exceptions in Section 300-1, but this is not readily apparent.

PANEL ACTION: Reject.

PANEL COMMENT: Section 300-8 does not apply to low-voltage signal wiring unless specifically referenced in Article 725.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 650

3- 42 - (300-10, Exception-(New)): Accept in Principle
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 5 for information.

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: Metal enclosures as covered in Section 250-33 Exception No. 2."

SUBSTANTIATION: To provide correlation with that section.

PANEL ACTION: Accept in Principle.

Revise last sentence of Section 300-10 to read as follows and add new Exceptions No. 1 and No. 2 as follows:

"Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures.

Exception No. 1: As provided in Section 370-7(c) for nonmetallic boxes.

Exception No. 2: As provided in Section 250-33, Exception No. 2 for metal enclosures."

PANEL COMMENT: The proposal essentially is accepted by adding the proposed exception. It then was logical to revise the last sentence of Section 300-10 and include a specific exception for nonmetallic boxes. The two exceptions were worded similarly for uniformity.

VOTE ON PANEL ACTION: Unanimously Affirmative.

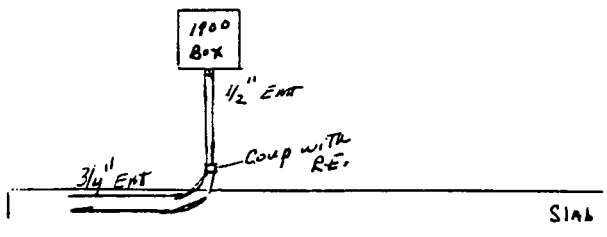
Log # 2362

3- 43 - (300-10(b)): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Raceways shall be installed as a complete system from box to box and shall not be reduced in size.

SUBSTANTIATION: The installer will be using a 3/4" conduit system and because the wire fill permits reducing say to 1/2" where the conduit comes out of the slab to the next box.



PANEL ACTION: Reject.

PANEL COMMENT: The submitter has not provided any substantiation for the proposal. There is no indication of any problem or hazard in reducing conduit size. A larger conduit may be used for a portion of a raceway system to provide for future expansion. The substantiation only refers to reducing conduit size and does not refer to complete raceway systems.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2364

3- 44 - (300-11(a)): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Revised text:

Raceways, cable assemblies, boxes, cabinets and fittings shall be securely fastened in place (using appropriate fitting or clamps) unless otherwise provided for specific purposes elsewhere in this Code.

SUBSTANTIATION: Raceways system, such as EMT, IMC, GRC, AC, MI, ENT should be fastened in place using appropriate fittings or clamps designed for that purpose, such as one hole straps, caddy fasteners, minitalac, unistrut, kindort straps. (Not tie wire)

It would also standardize the different articles.

EMT Art. 348-12 Securely fastened

RNM Art. 347-8 Supported

RMC Art. 346-12 Securely fastened in place.

IMC Art. 345-12 Securely fastened in place and supported

NMC Art. 336-5 Shall be secured by staple and straps

MCC Art 334-10 Shall be supported and secured

ACC Art. 383-7 AC Cable shall be secured by APPROVED straps, staples, hangers or similar fittings

ENT Art. 331-11 Shall be firmly fastened and secured

MI Art. 330-12 Shall be securely supported by straps, hangers, or similar fittings

PANEL ACTION: Reject.

PANEL COMMENT: The proposer's concern is adequately addressed in the sections listed in the substantiation. The Panel agrees that appropriate fittings or clamps are required and tie wires are not permitted.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1237

3- 45 - (300-11(a)): Accept

SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I.

RECOMMENDATION: Revise as follows:

Support wires that do not provide secure support shall not be used as the sole support.

SUBSTANTIATION: The rigid phrasing (pun intended) of this '87 Code addition has caused confusion as to the meaning and intent. Surely, there will be other proposed clarifications. This is one suggestion. "Stable" and "firm" are two other possibilities.

PANEL ACTION: Accept

PANEL COMMENT: This is a revised second sentence.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1664

3- 46 - (300-11(a)): Accept

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: Add a new sentence to read:

"Wiring not associated with equipment on or below the ceiling shall not be secured to ceiling support wires."

SUBSTANTIATION: Many code authorities consider ceiling support wires to provide rigid support for small raceways and boxes supplying equipment such as lay-in or recessed light fixtures providing the wires are adequate for the additional weight and the equipment is secured with properly designed fittings. The ceiling support wires should not be used for other raceways or equipment because if the ceiling was removed, lowered or modified, the rigid support would be affected. Utilizing the ceiling support wires only for equipment installed on or below the ceiling is reasonable and practical, especially where there is a large distance from permanent ceiling down to the suspended ceiling.

PANEL ACTION: Accept.

PANEL COMMENT: This would be a new third sentence.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2147

3- 47 - (300-11(a)): Accept in Principle

SUBMITTER: Rick L. Gifford, Kokomo, IN

RECOMMENDATION: Revise text:

Support wires that do not provide horizontal and lateral support shall not be used as the sole support.

SUBSTANTIATION: The term rigid is at best vague.

This at least will add some definition to the intent.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: Panel Action on Proposals 3-45 and 3-46 satisfies the submitter's intent.

The Panel recognizes that there are a number of possible terms or phrases such as stable, firm, horizontal and lateral support, etc. and the Panel believes that the word secure encompasses these and at the same time provides guidance about acceptable attachment without specifying a design constraint.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2778

3- 48 - (300-11(a)): Accept in Principle
SUBMITTER: Ann Shapiro, Farmington Hills, MI
RECOMMENDATION: Easily swayed support wires that do not provide stable support shall not be permitted as the sole support.
SUBSTANTIATION: Clarification.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: See Panel Comment for Proposal 3-47.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1347

3- 49 - (300-11(b), Exception No. 4-(New)):
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for action as the subject is under the jurisdiction of CMP 4. This action will be considered by the Panel as a Public Comment. It was action of the Correlating Committee that this proposal be reported as "Reject." It was the action of the Correlating Committee that this proposal be referred to CMP 16 for information.
SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association
RECOMMENDATION: Add a new Exception No. 4 as follows:
"Exception No. 4: as permitted in Section 800-11(a)(5) for communication service drops and Section 820-11(e)(4) for CATV cables."
SUBSTANTIATION: To recognize the long standing and necessary practice of supporting communication service drops from service-entrance masts. In the 1986 TCR, Panel Proposal 3-79 proposed an Exception No. 2 to address this issue. Although Panel 3 agreed unanimously, the Correlating Committee rejected it since Panel 3 did not have the primary jurisdiction. It was not coordinated with Panel 16 and did not appear in the 1987 NEC. Proposals have been submitted to Panel 16 to include the basic permission in Article 800 and 820 and this proposal will allow the coordination between Articles 300, 800 and 820.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Adelman, Wood.

EXPLANATION OF VOTE:

ADELMAN: Historically service entrance masts (raceway conduits) were provided for electric utility service drop conductors, be it open wire type or the more modern triplex type service conductors. With the additional strain of two more drops, telephone, and in many cases CATV, the possibility of conduit mast failure and roof leaking increases heavily. This will cause the homeowner additional expense to either increase conduit mast size or to provide "guying" for strength. (See Section 230-28.) From a safety point of view, it will place the telephone and CATV installers closer to energized electric utility conductors. The final consideration that must not be overlooked is the necessary separation that must be maintained between electric telephone and CATV, to meet N.E.S.C. requirements and/or other state law construction standards.

WOOD: The Sections referenced by Proposed Exception No. 4 do not presently appear in the Code. There is no assurance that Panel 16 will accept the Proposed changes.

Log # 1050

16- 2 - (300-11(b), Exception No. 4-(New)):
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for action. The Correlating Committee directs that this proposal be reported as "Reject". See Correlating Committee action on Proposal 3-49. This action will be considered by the Panel as a Public Comment. It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.
SUBMITTER: Larry W. Grovenstein, General Telephone Company of the South
RECOMMENDATION: Add Exception No. 4:
Telephone drops attached to masts or weatherheads where the mast is intended to be a structural support as described in Section 230-28.

SUBSTANTIATION: Clearly, most masts are intended for structural support and are also used as a raceway. The current Section 300-11(b) does not allow the attachment to the mast because it is a raceway, even though the mast is intended for use as a structural support. This has been a common practice for years.

An actual case of this confusion has already occurred in 1986 between General Telephone Company of the South and the City of Lexington, Kentucky Electrical Inspector. The issue was amicably resolved, however would not have occurred with the above clarification.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel believes the submitter's intent was accomplished by acceptance of Proposals 16-191 and 16-194.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 10

NEGATIVE: Treece.

EXPLANATION OF VOTE:

TREECE: Historically service entrance masts (raceway conduits) have been provided for the electric utility service drop conductors, be it open wire type or triplex type service conductors. With the additional strain of two more drops (telephone, and in many cases CATV), the possibility of conduit mast failure and roof leaking increases heavily. From a safety point of view, it will place the telephone and CATV installers closer to energized electric utility conductors. The final consideration that must not be overlooked is the necessary separation that must be maintained between electric, telephone, and CATV, to meet N.E.S.C. requirements and/or other state law construction standards.

The above will cause the homeowner additional expense to either increase conduit length, increase mast size, or provide "guying" for strength. (See Section 230-28.)

COMMENT ON VOTE:

BAGNALL: Panel comment should refer to Proposals 16-191 and 16-218 not 16-191 and 16-194 as shown!

Proposal 16-218 refers to attachments to supply service masts for Section 820 while Proposal 16-194 presently referred to in the Panel comment refers to a Section 800 wiring method unrelated to the service mast issue.

SCHALLHAMMER: The reference to 16-194 in the Panel Comment for this proposal does not apply and should be deleted.

WARE: The Panel Comment should reference Proposals 16-3 and 16-191 in lieu of 16-191 and 16-194.

Log # 1470

16- 3 - (300-11(b), Exception No. 4-(New)):
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 4 for action. The Correlating Committee directs that this proposal be reported as "Reject". See Correlating Committee action on Proposal 3-49. This action will be considered by the Panel as a Public Comment. It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.

SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association

RECOMMENDATION: Add a new Exception No. 4 as follows:

"Exception No. 4: as permitted in Section 800-11(a)(5) for communication service drops and Section 820-11(e)(4) for CATV cables."

SUBSTANTIATION: To recognize the long standing and necessary practice of supporting communication service drops from service-entrance masts. In the 1986 TCR, Panel 3 Proposal 3-79 proposed an Exception No. 2 to address this issue. Although Panel 3 agreed unanimously, the Correlating Committee rejected it since Panel 3 did not have the primary jurisdiction. It was not coordinated with Panel 16 and did not appear in the 1987 NEC. Proposals have been submitted to Panel 16 to include the basic permission in Article 800 and 820 and this proposal will allow the coordination between Articles 300, 800 and 820.

PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 10
NEGATIVE: Treece.
EXPLANATION OF VOTE:
TREECE: Same as Proposal 16-2.

Log # 1281

3- 50 - (300-12): Accept in Principle
Secretary's Note: The Correlating Committee directs the Panel to add a title in accordance with the NEC Style Manual. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Alan B. Cassady, City of Portland, OR, Bureau of Buildings
RECOMMENDATION: New second sentence:
Fittings and connectors for use with flexible cords, and metallic and non-metallic raceways and cables, shall be used only with the specific wiring methods for which they are designed and listed.
SUBSTANTIATION: Too many persons improvise connections for cords, cables, and raceways by using inappropriate connectors, which often do not adequately support or secure the wiring, and can contribute hazards to the circuit conductors.

The most frequently observed violations are the use of N.M. cable connectors with armored cable and flexible cords. The cord coverings often pull out of the clamps, and N.M. cable connectors do not protect the conductors from the cut ends of metallic jackets, and do not secure the anti-short bushings.

Other frequent mis-uses are the use of flexible conduit connectors and N.M. cable connectors with E.M.T. and P.V.C. conduit.

Including this information in the Code should add a degree of safety to otherwise improper installations, and save inspectors from having to write quite as many violation notices.

PANEL ACTION: Accept in Principle.

Add new Section 300-15(c) as follows:

"Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed."

PANEL COMMENT: The Panel revision is intended to cover multiple-use fittings and connectors that are listed for such multiple use and not restrict the requirement to the materials listed in the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 651

3- 51 - (300-12, Exception-(New)): Accept in Principle
SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception: Sections of raceways used to provide support or protection of cable assemblies from physical damage."

SUBSTANTIATION: To correlate with this permitted use of raceways (noncontinuous between boxes, cabinets, etc.) and remove a possible conflict.

PANEL ACTION: Accept in Principle.

Add word "Short" ahead of "Sections."

PANEL COMMENT: The addition of the word "short" is to correlate with the Panel Action on Proposal 3-42 adding a new Exception No. 2 referencing Section 250-33, Exception No. 2.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 652

3- 52 - (300-13(a)): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add: "in raceways" after "conductors".
SUBSTANTIATION: The intent appears to be directed to conductors in raceways but the literal wording "conductors shall be continuous" could apply to other wiring methods such as open wiring on insulators, knob and tube, messenger supported wiring, cable tray, etc.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 653

3- 53 - (300-13(a), Exception No. 5-(New)): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Add:

"Exception No. 5: Busways as covered in Article 364."

SUBSTANTIATION: Article 100 includes busways as raceways. In the various types (power, lighting, trolley, etc.) splices are normally made within the busway channel (raceway). Busway joints (splices) are referred to in Section 364-4(a) Exception d and 230-46 Exception No. 5.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1634

3- 54 - (300-13(b)): Accept

SUBMITTER: Joseph Misrahi, Metropolitan Transit Authority of Harris County

RECOMMENDATION: Insert "branch" between "multiwire" and "circuits"

SUBSTANTIATION: To agree with title and text of Section 210-4

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3255

3- 55 - (300-13(b)): Reject

SUBMITTER: James E. Goodnough, Contra Costa County Electrical Inspection

RECOMMENDATION: Revised text:

(b) Device Removal (Bold Type) In all circuits the continuity of a circuit shall not be dependent on device connections, such as lampholders, receptacles, etc., where the removal of such devices would interrupt the continuity.

SUBSTANTIATION: In this computer age, it is almost impossible to disconnect a circuit to replace devices. A device that is used as a splice, connector, or whatever you want to call it carries the total load of the downstream circuit through its device connections, and is therefore subject to failure. Replacement requires interruption of the downstream portion of the circuit, which results in total system loss in some computer systems. The Stab type connections in particular are prone to burnouts when carrying downstream loads.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the existing language provides for a safe installation and the substantiation does not provide sufficient documentation to warrant such a major change in wiring practices. Not using a device for circuit connections in computer circuits is a design consideration and not a safety or fire hazard. Installers are not required to use devices for circuit feed-through connections.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2473

3- 56 - (300-15(a), Exception No. 1): Reject

SUBMITTER: Donald Jakubowski, Lacks Ind.

RECOMMENDATION: Revised text:

"Conduit Bodies" having removable covers which are accessible after installation.

SUBSTANTIATION: "Conduit bodies" having removable covers which are accessible after installation, must meet the requirements of the Code, and be UL approved.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has not provided specific Code language and the Panel is unclear relative to what the submitter is proposing.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2493
3- 57 - (300-15(a), Exception No. 1): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 9 for information.

SUBMITTER: Harold Hogue, Grand Rapids, MI

RECOMMENDATION: Revised text:

A box or fitting shall not be required for a conductor splice connection in surface raceways, wireways, header ducts, multi-outlet assemblies, auxiliary gutters, cabletrays and conduit bodies "(in compliance with 370-6(c))" having removable covers which are accessible after installation.

SUBSTANTIATION: The wording of the exception leads you to believe that you can use any conduit body without regard to size.

PANEL ACTION: Accept in Principle.

Add in Section 300-15(a), Exception No. 1 of the present Code after the words "conduit bodies", also add "complying with Sections 370-6(c) and 370-18 and."

PANEL COMMENT: The Panel revision is more editorially correct. Reference to Section 370-18 was added since conduit bodies used as junction boxes must also comply with that section.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 108
3- 58 - (300-15(b), Exception No. 4): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Change Exception No. 4 to Exception No. 1. Renumber remaining exceptions.
SUBSTANTIATION: Editorial-to conform to the 1984 NEC Style Manual, Part A, A-2c.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1400
3- 59 - (300-15(b), Exception No. 9): Reject
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 7 for information.
SUBMITTER: W. Creighton Schwan, Hayward, CA
RECOMMENDATION: DELETE Exception No. 9 to Section 300-15(b)
SUBSTANTIATION: In the 1956 NEC Section 3347 was revised by this addition: "Where change is made from armored cable to other cable or raceway wiring methods, an outlet box shall be installed at junction point as required in Section 3007." With minor editorial revisions this requirement has remained in the Code up to the 1987 edition, where it is in the Section now numbered 333-9, with reference in the last line updated to "Section 300-15." (A change made in the 1987 NEC was to add "fitting or conduit body" after "box"; a desirable change which has nothing to do with this proposal.) This change in the 1956 Code was made because 1.: there was concern that removing the armor from several feet (the length is not limited in the Code) of conductors and then pulling those same conductors into a raceway would subject the conductors to abuse and physical damage not contemplated in their use within the Listed Armored Cable; and 2.: after pulling the conductors into the raceway, say EMT, with a connector at the end of the armor still remaining on the cable, screwed into a conduit coupling, which is in turn screwed into an EMT connector, and the cable and EMT properly fastened in place, there is no way, without removing either the cable or EMT supports, or both, to draw the conductors out of the EMT. This negates the use for which the EMT was designed: namely, as part of a pull-in, pull-out raceway system.

The proposal for the 1987 Code which resulted in the Exception in question was based on these circumstances: Armored Cable connected to EMT without a box. (See Proposal 3-88 on pg. 214 of NEC TCR 86-A). Exception No. 9 to Sec. 300-15(b) negates the purpose and the intent of the last sentence of Section 333-9, and should be DELETED.

Section 300-15(b), Exception No. 9, recognizes the misuse of two wiring methods, Armored Cable and Electrical Metallic Tubing, contrary to their intended use under the Code, and contrary to the conditions under which they are Listed by a recognized testing laboratory.

For these reasons, Exc. No. 9 to Sec. 300-15(b) should be deleted.

PANEL ACTION: Reject.

PANEL COMMENT: CMP 7 accepted adding the word "fitting" in Public Comment No. 7-44 of the 1986 NEC-TCO in recognition of Exception No. 9 to Section 300-15(b). As a result, it is apparent that CMP 7 has no objection to Exception No. 9. The practice recognized by Exception No. 9 has been common in many areas of the country with no apparent problems. Although Exception No. 9 may recognize a practice not originally intended for Type AC cable and EMT, the Panel does not agree that these wiring methods are misused. The conditions specified in Exception No. 9 provide for a safe installation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2996
3- 60 - (300-15, Exception No. 10-(New)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: A tenth exception should be added, as follows:

Exception No. 10: A supply connection to lighting track shall be permitted to be made through a fitting listed for this application.

SUBSTANTIATION: This proposal is to recognize the listed cable end feeds now widely available for lighting track installations; since that point of connection is the outlet, if this proposal is not accepted these listed fittings will remain outside the Code, and only the box and canopy end feed combination will be permitted.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal is not considered necessary because listed lighting track, like listed fixtures, has provision for wiring connections within them considered to be equivalent to a wiring box.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 107
9- 1 - (300-15(b), Exception No. 10-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: After Section 300-15(b), Exception No. 9, add:

"Exception No. 10: Non-metallic boxes shall be permitted for use only with nonmetallic wiring or non-metallic raceway."

SUBSTANTIATION: There are no code-approved guidelines for raceway grounding continuity where multiple metal/metallic raceway is used with such boxes.

PANEL ACTION: Reject.

PANEL COMMENT: Section 370-3 permits the use of non-metallic raceways with nonmetallic boxes. See Panel Proposal 9-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2330
3- 61 - (300-18-(New)): Accept in Principle
Secretary's Note: The Correlating Committee directs the Panel to add a title in accordance with the NEC Style Manual. This action will be considered by the Panel as a Public Comment.
SUBMITTER: George Straniero, Triangle PWC, Inc.
RECOMMENDATION: It is recommended that Article 300-18, which was deleted from the Code, be reinstated with the following language:

(a) "Raceways shall be installed complete from junction to junction prior to pulling conductors. A junction is either a terminating point or a splicing enclosure.

Exception 1. Exposed raceways having a removable cover.

Exception 2. Where an incomplete system is necessary to facilitate installation of motors.

Exception 3. Wiring in accordance with Articles 349 and 350.

(b) Pull wires, where used, shall not be installed until the raceway system is in place."

SUBSTANTIATION: A major function of a raceway is to protect conductors. If the raceway is incomplete when the conductors are pulled there is greater risk of damage to the conductors. Proposals to the last two Codes have, however, made it clear there are circumstances where some change was necessary. By requiring that only specific portions of the system be completed prior to pulling conductors, the problems previously stated with regard to large buildings is resolved. Installation of motors and fixture whips are resolved in Exceptions 2 and 3.

The ability of inspectors to inspect the completed raceway portion initially, then the conductors and terminations is more methodical. Contractors also have the opportunity to correct any raceway non-compliance before conductors are in place. Changes or completion of the raceway after pulling can result in wire damages which may not become apparent for an extended period of time.

PANEL ACTION: Accept in Principle.

Add new Section 300-18 to read as follows:

"Raceways shall be installed complete between outlet, junction or splicing points.

Exception No. 1: Exposed raceways having a removable cover.

Exception No. 2: Where required to facilitate the installation of utilization equipment.

Exception No. 3: Prewired assemblies in accordance with Articles 349 and 350."

PANEL COMMENT: The first two sentences were combined for clarity. Exception No. 1 was accepted as proposed. Exception No. 2 was revised to apply to all equipment where it is necessary to not complete the raceway system before installing conductors. Exception No. 3 was revised to clarify that it applies to prewired assemblies. Proposed (b) was not accepted since the submitter did not present any substantiation or identify the problem.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1532

3- 62 - (300-18-(New)): Reject

SUBMITTER: William Murphy, City of San Leandro

RECOMMENDATION: Add:

300-18 Inserting conductors in raceways:

(a) Raceways shall first be installed as a complete raceway system without conductors.

(b) Pull wires: Pull wires if to be used, shall not be installed until raceway system is in place.

(c) Lubricants: Cleaning agents or materials used as lubricants that have a deleterious effect on conductor coverings shall not be used.

Exception: Exposed raceways or exposed raceways with removable covers.

SUBSTANTIATION: This will prevent the pulling of conductors in poured in place concrete slabs, and decks above grade, prior to concrete placement.

E.M.T. in above grade decks with approved pot metal set screw fittings are prone to damage from vibrators and pump hoses.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal to install raceways as a complete system is impractical for many cases such as in large buildings, where required to facilitate installation of utilization equipment and prewired assemblies. See Panel Comment for Proposal 3-61 relative to pull wires. The submitter's substantiation does not address lubricants and there is no evidence that lubricants have or are causing problems.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2348

3- 63 - (300-18-(New) and Exceptions No. 1, 2 and

3-(New)): Accept in Principle

SUBMITTER: Lowell Lisker, AFC/A Nortek Company

RECOMMENDATION: Reinstate section 300-18 as stated in the 1981 code requiring raceways to be installed as a complete raceway system without the conductors. Add the following exceptions:

Exception No. 1: Exposed raceways having a removable cover or capping.

Exception No. 2: Where required to facilitate the installation of equipment such as large motors.

Exception No. 3: Prewired assemblies in accordance with Articles 349 and 350.

SUBSTANTIATION: Many installers are routing prewired raceways as though they are a cable system and are not adhering to the maximum number of quarter bends in a run making it virtually impossible to remove and reinstall wires. By installing the raceway system first, any problems the inspector locates can be corrected without damage to the conductors.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Comments for Proposals 3-61 and 3-62.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 245

3- 64 - (300-18-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Add new section as indicated:

"300-18. A conductor shall not be bent to a radius less than eight times the overall diameter on non-shielded conductors or twelve times the diameter of shielded or lead-covered conductors during or after installation."

(Note: A proposal to delete Table 346-10 which covers the radius of conduit/conductor bends is pending.)

SUBSTANTIATION: In the interest of safety, this proposal should be approved since this part of Article 300, which covers almost all wiring, contains no conductor bending-radius guidelines, the addition of such provisions is considered to be essential.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter did not provide any technical substantiation justifying the proposed bending radius. The Panel has no information confirming that bends of a smaller radius than proposed will damage the conductor. Individual articles address the bending radius of cables where necessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2777

3- 65 - (300-19(a) and Exception No. 1): Accept

SUBMITTER: Mark N. Shapiro, Farmington Hills, MI

RECOMMENDATION: Revised text:

Conductors in vertical raceways shall be supported if the vertical rise exceeds the values in Table 300-19(a).

Second sentence to remain.

Exception No. 1 to be deleted.

Exception No. 2 to remain.

SUBSTANTIATION: In practice, this rule is rarely obeyed or enforced. According to the literal wording of this Section, along with Ex. No. 1, support must be provided if #14 AWG conductors rise more than 25 ft. or if 500 MCM rises more than 12 1/2 ft. Practically any industrial shop has conduits coming out of the tops of switchboards and panelboards which run higher than that.

It's one thing to recognize a problem. It's another to have the understanding to formulate a proper solution. I found this rule in my oldest N.E.C. (a 1907 Edition). Cable technology has changed a lot since then. What is the main purpose behind this rule? Is the primary concern that stress not be added to panel terminals? Is the tensile strength of the cable the main concern? How does Ex. No. 2 fit into the picture?

This Section was once under the purview of C.M.P. 6. Perhaps a technical sub-committee is in order to examine the whole question from scratch.
PANEL ACTION: Accept.
PANEL COMMENT: Note Exception No. 2 becomes Exception.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1915

3- 66 - (Table 300-19(a)): Accept
SUBMITTER: Raymond P. Pelletier, City of Auburn, ME
RECOMMENDATION: Replace 0 AWG with 1/0 AWG
SUBSTANTIATION: To correlate with other 1/0 designations.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1989

3- 67 - (Table 300-19(a)): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change all occurrences of "MCM" to "kcmil" in the Table.
SUBSTANTIATION: The correct designation for the area of a conductor is cmil (circular mil) or kcmil (1,000 circular mils) and should be used when defining conductors larger than 4/0 AWG. "M" is the Roman designation for 1,000 while "k" is the English designation.
ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms, includes circular mil and all new IEEE Standards use the kcmil designation. Underwriters Laboratories and the Insulated Cable Engineers Association (ICEA) have also changed from the MCM designation to kcmil. It is important for consistency that the NEC also change to the kcmil designation.

Similar proposals are being submitted for all effected Sections of the NEC.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 654

3- 68 - (300-20): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add: "metal-jacketed cables (except Type MI)" after "Enclosures".
SUBSTANTIATION: For the same reason as the present rule; "enclosures" apparently does not include metal-covered cables.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel does not understand what the submitter is trying to accomplish. The submitter has not provided any specific problems that the proposal would cover.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 655

3- 69 - (300-20(a)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add: "metal-jacketed cables" after "enclosures".
SUBSTANTIATION: Per definition, and panel comment for Proposal 9-86 in the 1987 TCD, "enclosures" does not appear to cover metal-jacketed cables. Since currents can be induced in this metal it should be specifically covered.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 3-68.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2087

3- 70 - (300-20(a)): Reject
SUBMITTER: L. James Milne, Pyrotenax USA, Inc.
RECOMMENDATION: Revise as follows:
300-20(a) Where conductors carrying alternating current are installed in metal enclosures or metal raceways, they shall be so arranged as to avoid heating the surrounding metal by induction. To accomplish this, all phase conductors and, where used, the neutral and all equipment grounding conductors shall be grouped together. This is true of MI Cable which should be installed in conformance with table 300-20(a).
SUBSTANTIATION: The current wording of 300-20(a) states "Where conductors carrying alternating current are installed in metal enclosures or metal raceways . . ." which does not cover type MI cable as defined in 330-1. By this definition, type MI is neither conductors in a metal enclosure nor is it conductors in a metal raceway. As a manufacturer, we recommend installation procedures as noted in table 300-20(a).
Note: Supporting Material Available for Review at NFPA Headquarters.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel does not agree with including recommended installation practices as a mandatory Code requirement. The Code addresses installation practices effecting the practical safeguarding from hazards arising from the use of electricity. The Panel is not able to determine if the proposal is performance related or safety related and would need further information regarding its technical validity.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2997

3- 71 - (300-20(a), Exception No. 2): Accept
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Add "426-42 and Section" after the word "Section".
SUBSTANTIATION: Chapters 1 through 4 should internally correlate; 426-42 is another permitted example for skin effect heating like 427-47 now recognized.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 656

3- 72 - (300-20(a), Exception No. 3-(New)): Reject
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add:
"Exception No. 3: Where the wiring method is Type MI cable."
SUBSTANTIATION: The larger sizes of this type cable are single conductor type.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposals 3-68 and 3-70.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2531

3- 73 - (300-20(b)): Reject
SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association
RECOMMENDATION: Revised text:
Where a single conductor carrying alternating current "or direct current controlled by a static source" passes through metal with magnetic properties, the inductive effect shall be minimized by: 1) cutting slots in the metal between the individual holes through which the individual conductors pass, or 2) passing all the conductors in the circuit through an insulating wall sufficiently large for all the conductors of the circuit.
SUBSTANTIATION: Static devices used to convert alternating current (ac) to direct current (dc) and control voltage and current levels will generate harmonic currents in the dc. The frequencies of these harmonic currents will be multiples of the ac fundamental. Eddy currents induced in surrounding metal are a function of the square of the ac frequency,

so harmonics have a heating effect larger than the same level of fundamental current. By following the code rules for ac conductors, the heating effect of these harmonic currents can be canceled.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel judges this to be a system design consideration as opposed to a system installation requirement. The submitter has not provided any specific examples of field problems or related hazards associated with existing installations.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Jackson.

EXPLANATION OF VOTE:

JACKSON: It is a recognized fact that static devices used to convert alternating current (AC) to direct current (DC) generates harmonic currents in the DC. These harmonics can induce heating in steel conduits in the same way AC does if the positive and negative leads are run in separate conduits. One industry's account of incorrect installation is:

"We had a 350 hp DC motor at one of our plants with a static adjustable speed drive. Our field forces had run 2 - 500 MCM cables for the positive armature connections and the same for the negative connection. Unfortunately they ran the two positive conductors in one conduit and the two negative conductors in a separate conduit. They used aluminum conduits, so it was not a major problem, but we did have them reconnect so one positive and one negative conductor was in each conduit. There is no doubt that had they used steel conduits the conduits would have overheated."

The proposal's wording needs to be included in the Code to prevent this potential problem.

Log # 775

3- 74 - (300-21): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: In heading and in text change "products of combustion" to "smoke".

SUBSTANTIATION: The Ad Hoc Subcommittee is proposing that the term "products of combustion," where used in the 1987 Code, be changed to "smoke," as recommended by the NFPA Committee on Air Conditioning in Public Comment 1-104 for the 1987 Code and by the NFPA Toxicity Advisory Committee in Public Comment 3-95 for the 1987 Code. A definition of "smoke" is being proposed for Article 100, which is identical to the definition in NFPA-90A, as referenced in the Toxicity Advisory Committee Public Comment. The Ad Hoc Subcommittee believes that the term "smoke" in lieu of "products of combustion," with the accepted definition of "smoke," will clarify the intent. See Ad Hoc Subcommittee proposals for Sections 725-2(a), 760-2(a), 770-2(a), 800-3(c) and 820-14 for other proposed changes to "smoke."

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not justify the necessity of the proposal.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Gewain, Lawry.

EXPLANATION OF VOTE:

GEWAIN: The NEC should adopt the use of non-electrical terms which are consistent with those used by the sponsoring NFPA Committees. This will enable NFPA to coordinate and standardize terms.

LAWRY: I believe that changing "products of combustion" to "smoke" is a reasonable proposal. This change does not necessitate a definition of "smoke" in Article 100. With no definition in Article 100, the dictionary definition applies. The Panel did not provide any reason to justify not using the same definition as in NFPA 90A.

Log # 3291

3- 75 - (300-21, FPN-(New)): Reject

SUBMITTER: Richard G. Fransen, Ausimont

RECOMMENDATION: ADD FPN:

One method of defining resistance to the spread of fire is that the cables do not spread fire to the top of the tray in the Vertical Tray Flame Test in UL 1581.

SUBSTANTIATION: With the increased concern regarding the spread of fire for cables it is recommended that the current flame test be upgraded to enhance the safety of commercial and residential buildings.

PANEL ACTION: Reject.

PANEL COMMENT: Section 300-21 relates to installations in specific locations while the (FPN) relates to cables. Since there is no requirement for cables, the (FPN) is not necessary.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1841

3- 76 - (300-22, Exception No. 4): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Bernard J. Muslin, Argo Electric Inc.

RECOMMENDATION: Delete Exception No. 4.

SUBSTANTIATION: Same as Proposal 3-78.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has not submitted substantiation that the use of listed prefabricated cable assemblies of metallic manufactured wiring systems in environmental air spaces has significantly increased the spread of fire.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 776

3- 77 - (300-22(b)): Accept

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: At end of first sentence change "used for environmental air" to "specifically fabricated to transport environmental air."

SUBSTANTIATION: This change is to make the intent stated by the FPN mandatory.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1839

3- 78 - (300-22(b)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Bernard J. Muslin, Argo Electric Inc.

RECOMMENDATION: Revise as follows:

300-22: Wiring in Ducts, Plenums, and Other Air Handling Spaces. The provisions of this section apply to the installation and uses of electric wiring and equipment in ducts, plenums, and other air-handling spaces.

(FPN): See Article 424, Part F for Electric Duct Heaters.

(b) Ducts or Plenums Used for Environmental Air. Only wiring methods consisting of Type MI cable, Type MC cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering, electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, or rigid metal conduit shall be installed in ducts or plenums used for environmental air. (Flexible metal conduit) and liquidtight flexible metal conduit shall be permitted, in lengths not to exceed 4 feet (1.22 m), to connect physically adjustable equipment and devices permitted to be in these ducts and plenum chambers. (The connectors used with flexible metal conduit shall

effectively close any openings in the connection.) Equipment and devices shall be permitted within such ducts or plenum chambers only if necessary for their direct action upon, or sensing of, the contained air. Where equipment or devices are installed and illumination is necessary to facilitate maintenance and repair, enclosed gasketed-type fixtures shall be permitted.

(FPN): The above applies to ducts and plenums specifically fabricated to transport environmental air.

Note: Deleted material in parenthesis.

SUBSTANTIATION: The problem is an incongruity within the Code. All materials mentioned are sealed cable systems except flexible metallic conduit which is neither air tight, liquid tight, dust tight, or smoke tight. The tremendous amount of air - flow within the plenum makes the spread of fire and toxicity an imminent hazard, as the Las Vegas MGM Grand Hotel fire illustrates. The obvious solution to the need is - only cable systems that are sealed be allowed in the plenum.

By using flexible metallic tubing and connectors, which is now available in the 3/8" and 1/2" sizes only and liquid tight flexible metallic conduit in the 3/4" and larger sizes you have now sealed 90% of this very hazardous plenum ceiling.

Major urban areas with increasing numbers of high rise office buildings are requiring a sealed system. It is already under consideration in the state of New York. Hence, it behooves the National Electrical Code to reflect this necessary trend, to prevent future tragic loss of life.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has not submitted documentation justifying a sealed electrical system in ducts or plenums used for air-handling purposes. There is no evidence that the use of flexible metal conduit in ducts or plenums has significantly increased the spread of fire.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2471

3- 79 - (300-22(b)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: David Allen Parks, Rapid Engineering

RECOMMENDATION: In the second sentence I suggest that an air velocity restriction should be placed on the use of flexible conduit. (Flexible metal conduit and liquidtight flexible metal conduit shall be permitted, in lengths not to exceed 4 feet (122 m), with a maximum air velocity of 3000 feet per minute.

SUBSTANTIATION: This portion of the Code it seems would work fine for smaller air make-up units (residential, commercial) but the units that I deal with, produce, and service for industrial use are sometimes delivering 100,000 cfm and more. The velocity in the duct work are substantial. When flex is mounted in this duct work it becomes a very noise producing object, also the potential for physical damage is great. The most practical way I have seen it used in these places is when it is strapped carefully and frequently.

PANEL ACTION: Reject.

PANEL COMMENT: The issue of a wiring method producing noise is a design consideration, not a life or fire hazard to be determined by the Code. The submitter has not provided substantiation of problems of physical damage caused by excessive velocity. Special problems regarding this issue should be addressed in the respective Code articles. The submitter has offered a solution by properly strapping.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2806

3- 80 - (300-22(b)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: G. W. Flach, National Armored Cable Manufacturers Assoc.

RECOMMENDATION: Revise line 6 and line 9 to include "armored cable".

SUBSTANTIATION: Armored cable construction is consistent with the wiring systems (flexible metal conduit) presently recognized for use in lengths not exceeding 4 feet.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not agree that the construction of armored cable is equivalent to flexible metal conduit. The submitter has not provided substantiation to support his comment that armored cable is equivalent to flexible metal conduit for application in ducts or plenums in 4 foot lengths.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8.

NEGATIVE: Palivoda, Straniero.

EXPLANATION OF VOTE:

PALIVODA: The armor requirements for AC meet or exceed those for flexible metal conduit. Since the armor on AC is an approved equipment grounding conductor, I see no reason why it shouldn't be approved for this service.

STRANIERO: The substantiation submitted with this proposal is correct. A comparison of the UL standards covering flexible metal conduit UL-1 and armored cable UL-4 shows that the two products are physically the same and that the performance requirements for type AC are more stringent than those for flexible metal conduit.

Both type AC and FMC require a minimum armor thickness of .025" for small sizes. For larger sizes, the minimum thickness for type AC is .034" and for FMC .030".

Tension and elongation requirements for type AC are higher than for FMC. In fact, FMC has no elongation requirements.

Section 350-5 permits the armor of flexible metal conduit to serve as a grounding means provided the length does not exceed 6 ft. The maximum length permitted by Section 300-22(b) is 4 ft. which means FMC may be used as the grounding means. FMC has no resistance requirements. The armor of type AC has a maximum resistance requirement and is permitted as a grounding means without limit on its length; Section 250-91(b).

Overall the steel armor requirements for type AC meet or exceed those of flexible metal conduit. In addition, type AC is designed, manufactured, and tested to meet the electrical requirements for cable.

The suitability of type AC in 4 ft. lengths in ducts or plenums is based on its physical construction and performance criteria being equal or greater than the wiring system now permitted.

Log # 777

3- 81 - (300-22(b), FPN): Accept

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: Delete FPN.

SUBSTANTIATION: This change correlates with the Ad Hoc Subcommittee proposal for Section 300-22(b) to make the intent of the FPN mandatory, thus eliminating the need for the FPN.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

3- 82 - (300-22(c)): Accept

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: (1) Add new first sentence, as follows:

Section 300-22(c) applies to space used for environmental air-handling purposes other than ducts and plenums as specified in Sections 300-22(a) and 300-22(b)."

(2) At end of first paragraph change "other space used for environmental air" to "such other space."

(3) At end of third paragraph change "other space used for environmental air" to "such other space."

SUBSTANTIATION: The Ad Hoc Subcommittee is proposing that a definition of "plenum" be added to Article 100, which is substantially the same as the definition in NFPA-90A. Some of the spaces covered by Section 300-22(c) are plenums under the proposed definition. The Subcommittee is also proposing that the intent of the FPN under Section 300-22(b) be incorporated into mandatory language in Section 300-22(b), and that the FPN be deleted. This correlating proposal for Section 300-22(c) is to clarify its application with respect to the changes proposed for Section 300-22(b). Items (2) and (3) of this proposal are considered editorial for correlation with Item (1).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

3- 83 - (300-22(c)): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 8 for information.

The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: In Section 300-22(c) first line after "only" add "totally enclosed nonventilated busway having no provisions for plug-in connections and"

SUBSTANTIATION: This proposal was unanimously accepted by CMP 3 in the 1984 TCD. The Correlating Committee reported it as a reject because CMP 8 had rejected a similar proposal pending CMP 3 action. The CMP 8 Panel Comment was to reconsider pending CMP 3 action. But unfortunately, CMP 8 was not advised of the CMP 3 approval and did not reconsider. In the 1987 TCR a similar proposal was rejected and again because of CMP 8 action. However, since Section 300-22(c) in the 1987 NEC now permits solid bottom metal cable tray with solid metal covers, BUSWAY seems to be the only metallic method for enclosing conductors not permitted in this Section. Totally enclosed, nonventilated busway without provisions for plug-in connections does not create any more hazards than other metal raceways. A companion proposal has been submitted for Section 364-4(a).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

3- 84 - (300-22(c)): Accept

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Thomas A. Farkas, National Electrical Manufacturers Association

RECOMMENDATION: Reinstate "surface metal raceway" in Section 300-22(c) by modifying the second paragraph to read as follows:

"Other type cables and conductors shall be installed in electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, rigid metal conduit, flexible metal conduit, or where accessible, surface metal raceway or wireway with metal covers or solid bottom metal cable tray with solid metal covers."

SUBSTANTIATION: Issued as TIA 70-87-3 on July 16, 1987.

NEMA inadvertently omitted "surface metal raceway" when we submitted Code Proposal 3-116. This oversight would have a devastating affect on manufacturers of surface metal raceway because inspectors may challenge the use of surface metal raceway in "Spaces Used for Environmental Air" above a ceiling.

Previous Codes, going back to the 1975 NEC, permitted the use of surface metal raceway in "Other Spaces Used for Environmental Air." There was no technical justification for deleting "surface metal raceway" from the 1987 NEC. We believe that the potential restriction of this product from the marketplace justifies the "emergency nature" of this proposed TIA.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

3- 85 - (300-22(c)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Stanley Kaufman, AT & T Bell Laboratories

RECOMMENDATION: Between "use" and "shall" insert "and associated with equipment in the space."

SUBSTANTIATION: The present code permits "other factory-assembled multiconductor control or power cable which is specifically listed for the use shall be installed in other space used for environmental air." Consequently a listing laboratory may list any cable it deems acceptable for use. The present Code allows only metal-sheathed power cables and requires all other power wiring to be run in metallic raceway. Using the above provision, a listing laboratory could approve non-metallic-sheathed power cable for use in a plenum.

I think the above provision is too broad. The proposal would narrow its applicability by requiring association between the newly allowed cable and equipment in the plenum.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal to limit recognition of listed cables only to those associated with equipment in the space is overly restrictive. Actual problems which would be addressed by this proposal have not been identified.

VOTE ON PANEL ACTION: Unanimously Affirmative.

3- 86 - (300-22(c)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Bernard J. Muslin, Argo Electric Inc.

RECOMMENDATION: Revise 300-22(c) 2nd paragraph as follows:

300-22. Wiring in Ducts, Plenums, and Other Air-Handling Spaces. The provisions of this section apply to the installation and uses of electric wiring and equipment in ducts, plenums, and other air-handling spaces.

Other type cables and conductors shall be installed in electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, rigid metal conduit, (flexible metal conduit,) or where accessible, wireway with metal covers or solid bottom metal cable tray with solid metal covers.

Note: Deleted material in parenthesis.

SUBSTANTIATION: Same as Proposal 3-78.

PANEL ACTION: Reject.

PANEL COMMENT: The submitter has not submitted documentation justifying a sealed electrical system in other spaces used for environmental air. There is no evidence that the use of flexible metal conduit in other spaces for environmental air has significantly increased the spread of fire.

VOTE ON PANEL ACTION: Unanimously Affirmative.

3- 87 - (300-22(c)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Charles W. Forsberg, The Carlon Company
RECOMMENDATION: As a new second paragraph, add:

Nonmetallic environmental airspace tubing shall be installed only when conductors are utilized which have been listed as having adequate fire-resistant and low-smoke-producing characteristics.

(FPN): One method of defining low-smoke-producing cables is by establishing an acceptable value of the smoke produced per the NFPA 262-1985 test to a maximum peak optical density of 0.5 and a maximum average optical density of 0.15. Similarly, fire-resistant cables may be defined as having a maximum allowable flame travel distance of 5 feet (1.52 m) in the NFPA 262-1985 test.

Boxes and fittings used with nonmetallic environmental airspace tubing shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

SUBSTANTIATION: This is a companion to a proposal submitted to CMP 8 for a new article, Nonmetallic Environmental Airspace Tubing. This proposal introduces a new concept to the NEC; that is, a combustible raceway in other spaces used for environmental air. The logic behind these two proposals is that the raceway and conductors are to be evaluated by two separate procedures. Since there is currently no accepted standard for evaluating a combustible raceway in other spaces used for environmental air, this is one approach to be considered.

The evaluation of candidate materials will include fire hazard characteristics as well as electrical safety concerns. The end results is that the raceway will not add to the fire hazard for a building or the occupants in case of a fire.

This proposal will require that a nonmetallic raceway be evaluated for low-smoke and low-flame-spread requirements according to a yet to be developed procedure by Underwriters Laboratories. A companion proposal for Section 300-22(c) also requires that the

raceway contain only conductors which have been evaluated for adequate fire-resistant and low-smoke-producing characteristics according to NFPA 262-1985 when the raceway is installed in other spaces used for environmental air. This will assure building owners, engineers, and installers that the raceway will not add to the fire hazard for a building or the occupants.

Underwriters Laboratories is preparing a fact finding report which will be available for review by the Code panel. In the interim, UL Letter Report, November 4, 1987, File R13106, Project No. 87NK11793 contains a summary of test results, some of which are extracted for use with this proposal.

NOTE: Supporting Material Available For Review at NFPA Headquarters.

From an electrical safety viewpoint, the following tests have been conducted:

Tension and Elongation*
 Arcing
 Horizontal Pull In*
 Vertical Pull In*
 Heat Deflection (Wire Pull)*
 Thermal Expansion
 Resistance to Mechanical Abuse*
 Low Temperature Handling*
 Crush
 Impact*
 Water Absorption
 Flammability
 Specific Gravity
 Pull Through (Wall) Stud Test*
 Accelerated Oven Aging
 Oven Cycling Conditioning
 Low Temperature Wire Pull

Those results marked with an * indicate results not adequate to support listing of the product. The deficiencies appear to be resolvable through material modification or improvements in extrusion technology. Fire laboratory tests were conducted in a simulated plenum and in a modified Steiner tunnel with results as follows:

NONMETALLIC ENVIRONMENTAL AIRSPACE TUBING SIMULATED PLENUM TEST RESULTS

TEST NO.	SIZE	TOTAL SMOKE RELEASED IN DUCT - OPTICAL DENSITY - FT ²	TOTAL HEAT RELEASED (Kj)
14	1/2"	6117	84858
13	3/4"	6058	95440
9	1"	5728	82409
CTL#1		3663	85273
CTL#2		2110	102181

NONMETALLIC ENVIRONMENTAL AIRSPACE TUBING LABORATORY FLAMMABILITY TESTS RESULTS

TEST NO.	SIZE	FLAME TRAVEL - FT.	SMOKE OPTICAL PEAK	SMOKE DENSITY AVE.
1	1/2"	4.5	0.75	0.07
2	1/2"	4.5	0.43	0.05
8	3/4"	6.5	0.72	0.08
12	3/4"	7.0	0.53	0.07
13	3/4"	7.0	0.89	0.08
7	1"	8.0	0.72	0.08
11	1"	4.5	0.56	0.06
22	1"	4.5	0.35	0.03
26	1"	5.0	0.25	0.03

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation submitted is incomplete and more work and testing needs to be done on the product before it is acceptable. Substantiation refers to tests which need to be developed. The Panel believes test procedures should be complete with specific numbers identified. The Panel does not believe that this wiring system should be included in Section 300-22 since it has not been recognized by Panel 8.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3185

3- 88 - (300-22(c)): Reject

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ronald R. Bishop, The Carlon Company

RECOMMENDATION: As a new second paragraph, add:

Environmental airspace nonmetallic wiring system specifically listed for the use shall be permitted to be installed in other space used for environmental air. Boxes and fittings used with this system shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

SUBSTANTIATION: This is a companion to a proposal submitted to CMP 8 for a new article, Environmental Airspace Nonmetallic Wiring System. This system introduces a new concept to the NEC; that is, a combustible raceway and conductors for installation in other spaces used for environmental air. This system is required to meet low-smoke and low-flame-spread characteristics which are yet to be developed by Underwriters Laboratories. This is an alternate to a proposal for a new article, Nonmetallic Environmental Airspace Tubing, which would evaluate the combustible raceway and conductors separately.

The evaluation of candidate materials will include fire hazard characteristics of the system as well as electrical safety concerns for the raceway portion. The end result is to assure that the system will not add to the fire hazard for a building or the occupants in case of a fire.

Currently, General Electrical Ultem® 100 shows considerable promise for the raceway portion of the proposed system. Ultem has excellent high heat properties along with low-flame-spread and low-smoke characteristics.

Underwriters Laboratories is preparing a fact finding report which will be available for review by the code panel. In the interim, UL Letter Report, November 4, 1987, File R13106, Project No. 87NK11793 contains a summary of test results, some of which are extracted for use with this proposal.

NOTE: Supporting Material Available For Review at NFPA Headquarters.

From an electrical safety viewpoint, the following tests have been conducted on the raceway:

Tension and Elongation*

Arcing

Horizontal Pull In*

Vertical Pull In*

Heat Deflection (Wire Pull)*

Thermal Expansion

Resistance to Mechanical Abuse*

Low Temperature Handling*

Crush

Impact*

Water Absorption

Flammability

Specific Gravity

Pull Through (Wall) Stud Test*

Accelerated Oven Aging

Oven Cycling Conditioning

Low Temperature Wire Pull

Those results marked with an * indicate results not adequate to support listing of the product. The deficiencies appear to be resolvable through material modification or improvements in extrusion technology.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 3-87.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ENVIRONMENTAL AIRSPACE NONMETALLIC WIRING SYSTEM SIMULATED PLENUM FIRE TEST RESULTS

TEST NO.	PRODUCT	SIZE	WIRE ¹	TOTAL SMOKE RELEASED IN DUCT-OPTICAL DENSITY-FT ²	TOTAL HEAT-RELEASED - (Kj)
5	EANT	1/2"	10 FEP	7679	97550
8	FLEX.ALUM	1/2"	10 THHN	3017	89625
4	EMT	1/2"	10 THHN	3300	84453
12	EANT	3/4"	18 FEP	6637	92414
7	FLEX.ALUM.	3/4"	18 THHN	4123	86872
3	EMT	3/4"	18 THHN	3548	89717
11	EANT	1"	29 FEP	8274	99860
10	FLEX.ALUM.	1"	29 THHN	4063	85298
1	EMT	1"	29 THHN	3168	78189
CTL#1				3663	85273
CTL#2				2110	102181

1. all wire #12 AWG

ENVIRONMENTAL AIRSPACE NONMETALLIC WIRING SYSTEM
LABORATORY FLAMMABILITY TEST RESULTS

TEST NO.	PRODUCT	SIZE	WIRE ¹	FLAME TRAVEL- FT.	OPTICAL PEAK	DENSITY AVERAGE
5	EANT	1/2"	10 FEP	4.5	0.48	0.06
6	EANT	1/2"	10 FEP	4.0	0.55	0.05
3	FLEX.ALUM	1/2"	10 THHN	4.0	0.93	0.20
4	FLEX.ALUM	1/2"	10 THHN	4.5	1.33	0.27
25	EMT	1/2"	10 THHN	7.0	1.09	0.33
27	EMT	1/2"	10 THHN	4.5	0.86	0.24
24	EANT	3/4"	18 FEP	4.0	0.66	0.08
10	FLEX.ALUM.	3/4"	18 THHN	3.0	1.08	0.28
15	FLEX.ALUM.	3/4"	18 THHN	4.0	1.26	0.30
23	EMT	3/4"	18 THHN	5.0	1.33	0.34
30	EMT	3/4"	18 THHN	4.5	1.41	0.33
14	EANT	1"	29 FEP	4.5	0.14	0.02
18	EANT	1"	29 FEP	4.5	0.47	0.06
31	EANT	1"	29 FEP	5.0	0.08	0.02
32	EANT	1"	29 FEP	6.0	0.13	0.02
19	FLEX.ALUM.	1"	29 THHN	5.0	1.53	0.45
20	FLEX.ALUM.	1"	29 THHN	4.5	1.30	0.41
9	EMT	1"	29 THHN	8.0	1.50	0.60
29	EMT	1"	29 THHN	3.0	1.28	0.35

¹ All wire #12 AWG.

Log # 2824

3- 89 - (300-22(c), Exception No. 6): Accept
Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

It was the action of the Correlating Committee that this proposal be referred to CMP 12 for comment.

The Correlating Committee directs that this proposal be referred to the NFPA Committee on the Toxicity of the Products of Combustion for comment.

SUBMITTER: Joseph C. Reed, DuPont

RECOMMENDATION: Delete Exception #6.

SUBSTANTIATION: The movement of environmental air for ventilating these areas and equipment has the potential for spreading of flame and smoke beneath the raised floor or into the equipment area above the raised floor thus increasing the flame and smoke to a greater proportion.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2186

3- 90 - (300-22(c), Exception No. 7-(New)): Reject
Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Sandra McGee, Texas Instruments, Inc.

RECOMMENDATION: Revise Section 300-22(c) to add Exception No. 7:

Exception No. 7: Rigid non-metallic conduit may be used in highly corrosive areas (wet process) of self-contained clean rooms, such as, under-raised-floor returns for environmental air.

SUBSTANTIATION: Some areas of semiconductor manufacturing use highly corrosive acids and solvents in self-contained clean room atmospheres. Conduit needs to be protected from rapid corrosion to prevent possible short circuits; also to protect personnel required to work under raised floors (such as cleaning personnel) from possible contact with exposed hot conductors. Section 347-2B allows the use of PVC conduit for corrosive areas, but presently Section 300-22C does not permit PVC conduit in environmental air plenums.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel questions what specific applications where highly corrosive acids and solvents in air handling spaces are creating hazards. The Panel needs further substantiation and information to evaluate the need for this proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 779

3- 91 - (300-22(c), FPN): Accept

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on Air Conditioning for comment.

SUBMITTER: Ad Hoc Subcommittee on Smoke, NEC Correlating Committee

RECOMMENDATION: Revise FPN to read as follows:

"(FPN): The space over a hung ceiling used for environmental air-handling purposes is an example of the type of other space to which Section 300-22(c) applies."

SUBSTANTIATION: The changes being proposed for Sections 300-22(b) and 300-22(c) by the Ad Hoc Subcommittee eliminate the need for an explanation of intent in the FPN. However, the Subcommittee believes that an example of a space covered by Section 300-22(c) is still needed, and proposes that the FPN be revised to provide this example.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 927

3- 92 - (Article 300, Part B, Title): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change the title of Part B to read:

"B. Requirements for Medium- and High-Voltage Installations"

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Palivoda, Straniero.

EXPLANATION OF VOTE:

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 928

3- 93 - (300-32): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change text to read as follows:

300-32. CONDUCTORS OF DIFFERENT SYSTEMS. Conductors of medium-voltage or high-voltage systems shall not occupy the same wiring enclosure or pull and junction boxes with conductors of low-voltage systems.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept in Principle.

Insert "extra-low or" ahead of "low-voltage."

PANEL COMMENT: See Panel Comment for Proposal 3-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 929

3- 94 - (300-32, Exception No. 2): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change text to read as follows:

EXCEPTION NO. 2: In manholes, if low-voltage conductors are separated from medium or high-voltage conductors.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept in Principle.

Insert "extra-low or" ahead of low-voltage.

PANEL COMMENT: See Panel Comment for Proposal 3-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 1261

3- 95 - (300-35): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the last line of the sentence as indicated:

... (by induction.) "in accordance with the applicable provisions of Section 300-20."

SUBSTANTIATION: For reasons of safety, this change should be made to ensure more adequate/meaningful remedial guidelines and Code-required compliance.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 305 --- TEMPORARY WIRING

Log # 1212

3- 96 - (305-3(b)): Reject

SUBMITTER: Edward R. Russell, Lee County Code Enforcement

RECOMMENDATION: Add to 305-3(b):

Christmas decorative light shall be permitted for a period not to exceed 90 days in any one year.

Note: Temporary needs to be defined under definitions, Chapter 1-General, Article 100.

SUBSTANTIATION: Christmas decorative string lighting is being installed on a permit basis. The current Code enables the violator to remove said lighting in any 89 day cycle, and reinstall and be in compliance with NFPA 70, 305-3(b) as currently written.

According to Underwriters Laboratories, Christmas tree and decorative lighting outfits were not tested or designed for permanent installation

PANEL ACTION: Reject.

PANEL COMMENT: This problem appears to be an enforcement problem and is addressed in Section 305-3(b). The Panel agrees that it is not the intent of the Code to permit Christmas decorative lighting to be installed for 89 days, removed and reinstalled in the same location within a short period of time.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2465

3- 97 - (305-3(b)): Reject

SUBMITTER: Mike Minihan, Kentwood, MI

RECOMMENDATION: Revised text:

B. Temporary electrical power and lighting installations shall be permitted for a period not to exceed 90 days for Christmas decorative lighting, carnivals and similar purposes. Installation date shall be recorded for the authority having jurisdiction. SUBSTANTIATION: This will keep people from exceeding the 90 day period and keep the wiring as safe as possible in areas where people will be for prolonged periods of time. (i.e. carnivals).

PANEL ACTION: Reject.

PANEL COMMENT: The problem addressed by the submitter is an enforcement problem and not a Code related issue.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1959

3- 98 - (305-4(a)): Reject

SUBMITTER: Terry L. Carlson, Norfolk, NE

RECOMMENDATION: Add new wording to read:

(a) Services. Services shall be installed in conformance with Article 230. Where the service is installed for construction jobsite mobile trailers of any type, it shall be installed in conformance with Section 550-5.

SUBSTANTIATION: Section 550-4(a) does not address the most common type of jobsite trailer which is the semi truck tractor type reefer. These trailers are commonly wired with the service equipment installed on the outside wall using the meter loup service riser conduit for the point of attachment of the overhead service drop conductors. This creates a possibly hazardous installation with the unfused conductors attached to the metal trailer. The trailer is on rubber tires and normally wooden blocks are placed under the dolly wheels, creating a non-grounded metal structure that can become energized, causing potential safety hazards. Requiring the insulated 4-wire mobile home type service and feeder will increase the safety of the installation. Adding the wording to Section 305-4(a) would require all construction jobsite trailers that require power to be wired with the 4-wire insulated conductor system. This would reduce the chance that the metal skin or frame of the trailer could be energized by either a short circuit, ground fault, or simply a bonded neutral in the meter socket on the side of the trailer.

PANEL ACTION: Reject.

PANEL COMMENT: The practice covered by the submitter's proposal is a common method of installation for these trailers. The submitter has not provided any specific examples of problems resulting from this practice. Wiring associated with these installations is required to comply with Section 305-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2238

3- 99 - (305-4(b) and (c)): Accept in Principle

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Joseph Penachio, Revere, MA

Log # 928

3- 93 - (300-32): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change text to read as follows:

300-32. CONDUCTORS OF DIFFERENT SYSTEMS. Conductors of medium-voltage or high-voltage systems shall not occupy the same wiring enclosure or pull and junction boxes with conductors of low-voltage systems.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept in Principle.

Insert "extra-low or" ahead of "low-voltage."

PANEL COMMENT: See Panel Comment for Proposal 3-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 929

3- 94 - (300-32, Exception No. 2): Accept in Principle

SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee

RECOMMENDATION: Change text to read as follows:

EXCEPTION NO. 2: In manholes, if low-voltage conductors are separated from medium or high-voltage conductors.

SUBSTANTIATION: Same as Proposal 3-3.

PANEL ACTION: Accept in Principle.

Insert "extra-low or" ahead of low-voltage.

PANEL COMMENT: See Panel Comment for Proposal 3-3.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Gewain, Palivoda, Straniero.

EXPLANATION OF VOTE:

GEWAIN: Same as Proposal 3-3.

PALIVODA: Same as Proposal 3-3.

STRANIERO: Same as Proposal 3-3.

Log # 1261

3- 95 - (300-35): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the last line of the sentence as indicated:

... (by induction.) "in accordance with the applicable provisions of Section 300-20."

SUBSTANTIATION: For reasons of safety, this change should be made to ensure more adequate/meaningful remedial guidelines and Code-required compliance.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE 305 --- TEMPORARY WIRING

Log # 1212

3- 96 - (305-3(b)): Reject

SUBMITTER: Edward R. Russell, Lee County Code Enforcement

RECOMMENDATION: Add to 305-3(b):

Christmas decorative light shall be permitted for a period not to exceed 90 days in any one year.

Note: Temporary needs to be defined under definitions, Chapter 1-General, Article 100.

SUBSTANTIATION: Christmas decorative string lighting is being installed on a permit basis. The current Code enables the violator to remove said lighting in any 89 day cycle, and reinstall and be in compliance with NFPA 70, 305-3(b) as currently written.

According to Underwriters Laboratories, Christmas tree and decorative lighting outfits were not tested or designed for permanent installation

PANEL ACTION: Reject.

PANEL COMMENT: This problem appears to be an enforcement problem and is addressed in Section 305-3(b). The Panel agrees that it is not the intent of the Code to permit Christmas decorative lighting to be installed for 89 days, removed and reinstalled in the same location within a short period of time.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2465

3- 97 - (305-3(b)): Reject

SUBMITTER: Mike Minihan, Kentwood, MI

RECOMMENDATION: Revised text:

B. Temporary electrical power and lighting installations shall be permitted for a period not to exceed 90 days for Christmas decorative lighting, carnivals and similar purposes. Installation date shall be recorded for the authority having jurisdiction. SUBSTANTIATION: This will keep people from exceeding the 90 day period and keep the wiring as safe as possible in areas where people will be for prolonged periods of time. (i.e. carnivals).

PANEL ACTION: Reject.

PANEL COMMENT: The problem addressed by the submitter is an enforcement problem and not a Code related issue.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1959

3- 98 - (305-4(a)): Reject

SUBMITTER: Terry L. Carlson, Norfolk, NE

RECOMMENDATION: Add new wording to read:

(a) Services. Services shall be installed in conformance with Article 230. Where the service is installed for construction jobsite mobile trailers of any type, it shall be installed in conformance with Section 550-5.

SUBSTANTIATION: Section 550-4(a) does not address the most common type of jobsite trailer which is the semi truck tractor type reefer. These trailers are commonly wired with the service equipment installed on the outside wall using the meter loup service riser conduit for the point of attachment of the overhead service drop conductors. This creates a possibly hazardous installation with the unfused conductors attached to the metal trailer. The trailer is on rubber tires and normally wooden blocks are placed under the dolly wheels, creating a non-grounded metal structure that can become energized, causing potential safety hazards. Requiring the insulated 4-wire mobile home type service and feeder will increase the safety of the installation. Adding the wording to Section 305-4(a) would require all construction jobsite trailers that require power to be wired with the 4-wire insulated conductor system. This would reduce the chance that the metal skin or frame of the trailer could be energized by either a short circuit, ground fault, or simply a bonded neutral in the meter socket on the side of the trailer.

PANEL ACTION: Reject.

PANEL COMMENT: The practice covered by the submitter's proposal is a common method of installation for these trailers. The submitter has not provided any specific examples of problems resulting from this practice. Wiring associated with these installations is required to comply with Section 305-5.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2238

3- 99 - (305-4(b) and (c)): Accept in Principle

Secretary's Note: The Correlating Committee directs that the Panel clarify the Panel Action on this proposal. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Joseph Penachio, Revere, MA

RECOMMENDATION: The second sentences should be rephrased as follows:

"Conductors shall be permitted within cable assemblies, or multiconductor cord of a type identified in Table 400-4 . . ."

SUBSTANTIATION: As presently written, "cable assemblies are required to be identified in Table 400-4."

PANEL ACTION: Accept in Principle.

Add "; or," after assemblies and "or cable" after cord in the third sentence in (b) and second sentence in (c).

PANEL COMMENT: Table 400-4 includes cables as well as cords.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

LAWRY: Revise the third sentence in Section 305-4(b) and the second sentence in Section 305-4(c) to read: "Conductors shall be permitted within cable assemblies; or, multiconductor cord or cable of a type identified in Table 400-4 for hard usage or extra hard usage".

Log # 3143

3- 100 - (305-4(c)): Reject

SUBMITTER: William M. Swanson, Jr., Newton, MA

RECOMMENDATION: Revised text:

No open wiring shall be used for branch circuits or lighting circuits. They shall be in listed or labelled cord or cable.

SUBSTANTIATION: Sprinkler fitter South Station job, Boston - shocked with open wiring. Children's Hospital - pipe cover pushed staging into open wiring energizing staging and had to be hospitalized. Belmont High - open wiring left in ceiling. There is no approved connectors to bring open wiring in panel.

PANEL ACTION: Reject.

PANEL COMMENT: Use of insulated conductors run as open wiring for temporary construction work is a very common application. The Panel believes that this is a safe practice where installed according to the applicable requirements of Article 305.

Approved connectors are not required under Article 305 where insulated conductors enter the panel.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 657

3- 101 - (305-4(g)): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Revise last sentence:

"A box, conduit body, or terminal fitting having a separately bushed hole for each conductor shall be used wherever a change is made to a conduit or tubing system, or a metal-jacketed cable system."

SUBSTANTIATION: Conduit bodies and terminal fittings as permitted or required elsewhere in the Code for permanent wiring, should also be suitable. (Sections 300-15(b) Exception No. 6, 300-16(a)).

"Conduit or tubing" is proposed in lieu of raceways, as cables or cord assemblies connected to wireways; for example would not require a box. "Metal-clad" and "metal-sheathed" infer or specify the wiring methods of Articles 330 and 334; "metal-jacketed" is a generic term and includes all types.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 246

3- 102 - (305-4(h), (FPN)-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: After 305-4(h), add as indicated:

"(FPN): For conductor bending radius requirements, see Section 300-18."

(Note: Section 300-18 is contained in a pending proposal.)

SUBSTANTIATION: This revision should be approved because this article does not provide any conductor bending radius guidelines.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment for Proposal 3-64.

In accordance with Section 305-2, the bending radius of individual articles would apply for temporary wiring.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1219

3- 103 - (305-6): Reject

SUBMITTER: Earl W. Roberts, Reptec

RECOMMENDATION: Revise as follows:

305-6 Ground-Fault Protection for Personnel.

Ground-fault protection for personnel on construction sites shall be provided as follows:

(a) Ground-Fault Circuit-Interrupters.

(Same as 1987 N.E. Code, including Exception.)

(b) Assured Equipment Grounding Program. In specific construction site installations, where the authority having jurisdiction agrees that it is impractical to provide total Ground-Fault Protection for Personnel as provided by (a) above, it shall, be permitted to use an Assured Equipment Grounding Program, implemented as follows:

(Remainder of present 305-6(b) - no change.)

SUBSTANTIATION: An "Assured Equipment Grounding Conductor Program" does not provide the equivalent personnel protection that a GFCI provides. The program merely gives some assurance that the equipment grounding conductor path is complete at the time of test.

The equipment grounding conductor provides NO protection when the person is the only path from a live conductor to ground. This protection IS provided by the GFCI.

PANEL ACTION: Reject.

PANEL COMMENT: No substantiation or documentation was provided to verify that assured equipment grounding does not provide a safe installation. The present wording of Section 305-6 is consistent with the requirement of OSHA which has primary jurisdiction over construction site safety.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3465

3- 104 - (305-6): Reject

SUBMITTER: John P. Leith, Fairfield, AL

RECOMMENDATION: New text:

All receptacles regardless of voltage that are outside of any structure shall be on GFCI also any equipment that is wired direct regardless of voltage shall be connected to GFCI that are outside of a structure. This proposal shall include Temporary service before a structure is built.

SUBSTANTIATION: SAFETY. Most of GFCI receptacles are just at Dwellings.

PANEL ACTION: Reject.

PANEL COMMENT: The proposal does not comply with the NFPA Regulations Governing Committee Projects because specific text and code reference is not provided. Also, the submitter has not provided any examples of installations where problems have arisen requiring GFCI protection of all receptacles and outside equipment.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 658

3- 105 - (305-6(a)): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Change "employees" to "personnel".

SUBSTANTIATION: "Employees" is a narrow term which may not cover all persons utilizing the receptacles. A self-employed contractor for instance is legally not regarded as an "employee" in many instances. The word "personnel" is used in the first paragraph (and in many other Code sections), then narrowed in scope to "employees" in (a).

PANEL ACTION: Reject.

PANEL COMMENT: The present use of the word "employees" in Section 305-6(a) is consistent with the language used by OSHA and it is the Panel's intent to maintain as much consistency as possible with OSHA terminology.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2998

3- 106 - (305-6(b)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: The subsection should be revised by adding the words "acceptable to the authority having jurisdiction" after the word "procedure".
SUBSTANTIATION: These words were in the 1981 NEC when this section was located in 210-8. When this section was relocated in 1984, the words were removed, but no substantiation appeared in the TCR to support the change. This phrase should be restored in order to provide effective enforcement. Local control over the timing of and record keeping procedures for testing are essential, especially for part-time inspection authorities.
PANEL ACTION: Reject.
PANEL COMMENT: The existing text of Section 305-6 was directed primarily towards OSHA enforcement and to change text as the submitter proposed would be inconsistent with OSHA's regulations.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3144

3- 107 - (305-6(b)): Reject
SUBMITTER: William M. Swanson, Jr., Newton, MA
RECOMMENDATION: Delete from the code - go 100% GFCI.
SUBSTANTIATION: Violations where ground assurance is not being used. Carpenter killed in Philadelphia, hand held tool.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 3-103. In addition, the Panel does not have details of the specific case cited to determine the validity of the substantiation.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 930

3- 108 - (305-7): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change Section 305-7 to read as follows:
"305-7. Guarding. For temporary medium-, and high-voltage wiring, suitable fencing, barriers, or other effective means shall be . . . personnel."
SUBSTANTIATION: The primary purpose of this Section is to prevent an accident where a person completes a circuit to ground. On this premise, the proposed wording merely re-states the existing requirement in new terms.
Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium-, and high voltage circuits, equipment and systems (Article 100 proposals).
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Palivoda, Straniero.
EXPLANATION OF VOTE:
PALIVODA: Same as Proposal 3-3.
STRANIERO: Same as Proposal 3-3.

ARTICLE 310 -- CONDUCTORS FOR GENERAL WIRING

Log # 111

6- 1 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the fourth paragraph as indicated:

When equipment grounding conductors are used with conductors "or cables" in parallel, they shall comply with the requirements of this section except that they shall be sized as per Section 250-95.
SUBSTANTIATION: Able should be included in this paragraph because it is referred to as a wiring method elsewhere in this Code, see the sentence following Section 310-4(5), for example.
PANEL ACTION: Reject.
PANEL COMMENT: Conductors are components of cables and the proposal change is unnecessary.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 112

6- 2 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the sentence following Section 310-4(5) as indicated:
Where run in separate raceways or cables the raceways or cables shall have the same characteristics(.) "and the neutral, where used, shall be sized to meet the applicable provisions of Section 220-22".
SUBSTANTIATION: The change is needed to ensure that properly sized neutral conductors, where required, are installed especially where many conductors/cables are paralleled to supply: (1) neutral load; or (2) electric discharge lighting/data processing equipment.
PANEL ACTION: Reject.
PANEL COMMENT: Sizing of neutral conductor is adequately covered in Article 220. It is not necessary to reference it in this section.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 113

6- 3 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the first sentence only as indicated:
. . . and larger, comprising each phase or neutral, "and equipment grounding conductor, where wire is used, shall".
SUBSTANTIATION: The wording used in the second sentence does not clearly express the intended meaning/idea. This has given rise to a multitude of: (1) wiring-errors; (2) conflicting Code interpretations. Paralleled conductor length requirements are applicable to equipment grounding conductors (where paralleled wires are used).
It should be noted that the added explanatory "Fine Print Note" may not solve the problem; because: (1) FPNs are relatively new and are not widely used or understood; and (2) the "fine" print is hard to read.
Based on the above, this proposal should be approved for the safety of life and property.
PANEL ACTION: Reject.
PANEL COMMENT: Requirements for equipment grounding conductors are already contained in Section 310-4.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 749

6- 4 - (310-4): Reject
SUBMITTER: Robert J. Friebe, Pennsville, NJ
RECOMMENDATION: After the first sentence, change the wording to read -
The paralleled conductors in each and all phases or neutral shall:
(1) Be approximately the same length;
(2) Have the same conductor material;
(3) Be the same size in circular MIL area;
(4) Have the same insulation type;
(5) Be terminated in the same manner
Note: The remainder of Article 310-4 will remain as written, except the FNN, and that shall be removed.
SUBSTANTIATION: In order to insure a more reliable installed job and installed in a workmanlike manner, we should accept the above changes.
I am very concerned when we are allowed to mix conductors of different materials. We will run into a big problem in proper termination.

PANEL COMMENT: The present use of the word "employees" in Section 305-6(a) is consistent with the language used by OSHA and it is the Panel's intent to maintain as much consistency as possible with OSHA terminology.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2998

3- 106 - (305-6(b)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: The subsection should be revised by adding the words "acceptable to the authority having jurisdiction" after the word "procedure".
SUBSTANTIATION: These words were in the 1981 NEC when this section was located in 210-8. When this section was relocated in 1984, the words were removed, but no substantiation appeared in the TCR to support the change. This phrase should be restored in order to provide effective enforcement. Local control over the timing of and record keeping procedures for testing are essential, especially for part-time inspection authorities.
PANEL ACTION: Reject.
PANEL COMMENT: The existing text of Section 305-6 was directed primarily towards OSHA enforcement and to change text as the submitter proposed would be inconsistent with OSHA's regulations.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3144

3- 107 - (305-6(b)): Reject
SUBMITTER: William M. Swanson, Jr., Newton, MA
RECOMMENDATION: Delete from the code - go 100% GFCI.
SUBSTANTIATION: Violations where ground assurance is not being used. Carpenter killed in Philadelphia, hand held tool.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment for Proposal 3-103. In addition, the Panel does not have details of the specific case cited to determine the validity of the substantiation.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 930

3- 108 - (305-7): Accept
SUBMITTER: Ad Hoc Subcommittee on Voltages, NEC Correlating Committee
RECOMMENDATION: Change Section 305-7 to read as follows:
"305-7. Guarding. For temporary medium-, and high-voltage wiring, suitable fencing, barriers, or other effective means shall be . . . personnel."
SUBSTANTIATION: The primary purpose of this Section is to prevent an accident where a person completes a circuit to ground. On this premise, the proposed wording merely re-states the existing requirement in new terms.
Proposal is to obtain consistency in voltage terminology throughout the Code and incorporate recognized industry standards and practices. See proposed definitions of low-, medium-, and high voltage circuits, equipment and systems (Article 100 proposals).
PANEL ACTION: Accept.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Palivoda, Straniero.
EXPLANATION OF VOTE:
PALIVODA: Same as Proposal 3-3.
STRANIERO: Same as Proposal 3-3.

ARTICLE 310 -- CONDUCTORS FOR GENERAL WIRING

Log # 111

6- 1 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the fourth paragraph as indicated:

When equipment grounding conductors are used with conductors "or cables" in parallel, they shall comply with the requirements of this section except that they shall be sized as per Section 250-95.
SUBSTANTIATION: Able should be included in this paragraph because it is referred to as a wiring method elsewhere in this Code, see the sentence following Section 310-4(5), for example.
PANEL ACTION: Reject.
PANEL COMMENT: Conductors are components of cables and the proposal change is unnecessary.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 112

6- 2 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the sentence following Section 310-4(5) as indicated:
Where run in separate raceways or cables the raceways or cables shall have the same characteristics(.) "and the neutral, where used, shall be sized to meet the applicable provisions of Section 220-22".
SUBSTANTIATION: The change is needed to ensure that properly sized neutral conductors, where required, are installed especially where many conductors/cables are paralleled to supply: (1) neutral load; or (2) electric discharge lighting/data processing equipment.
PANEL ACTION: Reject.
PANEL COMMENT: Sizing of neutral conductor is adequately covered in Article 220. It is not necessary to reference it in this section.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 113

6- 3 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the first sentence only as indicated:
. . . and larger, comprising each phase or neutral, "and equipment grounding conductor, where wire is used, shall".
SUBSTANTIATION: The wording used in the second sentence does not clearly express the intended meaning/idea. This has given rise to a multitude of: (1) wiring-errors; (2) conflicting Code interpretations. Paralleled conductor length requirements are applicable to equipment grounding conductors (where paralleled wires are used).
It should be noted that the added explanatory "Fine Print Note" may not solve the problem; because: (1) FPNs are relatively new and are not widely used or understood; and (2) the "fine" print is hard to read.
Based on the above, this proposal should be approved for the safety of life and property.
PANEL ACTION: Reject.
PANEL COMMENT: Requirements for equipment grounding conductors are already contained in Section 310-4.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 749

6- 4 - (310-4): Reject
SUBMITTER: Robert J. Friebe, Pennsville, NJ
RECOMMENDATION: After the first sentence, change the wording to read -
The paralleled conductors in each and all phases or neutral shall:
(1) Be approximately the same length;
(2) Have the same conductor material;
(3) Be the same size in circular MIL area;
(4) Have the same insulation type;
(5) Be terminated in the same manner
Note: The remainder of Article 310-4 will remain as written, except the FNN, and that shall be removed.
SUBSTANTIATION: In order to insure a more reliable installed job and installed in a workmanlike manner, we should accept the above changes.
I am very concerned when we are allowed to mix conductors of different materials. We will run into a big problem in proper termination.

PANEL ACTION: Reject.
PANEL COMMENT: The Panel believes that the fine print note is needed to help assure equal distribution of current, approximately is undefined.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1146

6- 5 - (310-4): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the first sentence as indicated:
... each phase (or) "and, where used, the" neutral (comma) "and the equipment grounding conductor" shall .
SUBSTANTIATION: The word "or" is misleading because it provides an alternative which means that the requirement applies to the paralleled conductors in each phase or the neutral. By Code intent, the requirement applies equally to the phase conductors and, where used, the neutral and the equipment grounding conductor.

In the interest of safety, paralleled equipment grounding conductors should also be directly addressed as are the other conductors. It should be noted that paralleled equipment grounding conductors are referred to in the fourth paragraph as follows: "When equipment grounding conductors are used with conductors in parallel, they shall comply with the requirements of this section . . .". This is not sufficiently clear because this section contains no other reference(s) to equipment grounding conductors and it is not clear whether the equipment grounding conductor referred to in this paragraph is a single or paralleled equipment grounding conductor.

The terms "the neutral" and "the equipment grounding conductor" are used in this proposal because when conductors are paralleled a single conductor is formed as indicated in section 310-4.

PANEL ACTION: Reject.
PANEL COMMENT: Already covered in Section 250-95 as referenced in Section 310-4, 4th paragraph.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1471

6- 6 - (310-4): Accept in Principle
SUBMITTER: L. H. Sessler, Exchange Carriers Standards Association
RECOMMENDATION: In the first sentence change "neutral" to "grounded circuit conductor."
SUBSTANTIATION: The intent of the rule is to apply to current carrying conductors. Since neutral conductors are a subset of grounded circuit conductors, the change is proposed to make the rule consistent with the intent.
PANEL ACTION: Accept in Principle.

Revise the proposal as follows: delete "or" between "phase" and "neutral" and replace with a comma: Add "or grounded circuit conductor" after "neutral".

In addition, for correlation, in the second paragraph, first line, make the same revision as above. In the FPN make the same change as above in the second sentence.

PANEL COMMENT: Both terms are needed since not all grounded conductors are neutrals.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2476

6- 8 - (310-4): Reject
SUBMITTER: Barry D. Curtis, Ionia, MI
RECOMMENDATION: Move the paragraph; (the paralleled conductors in each phase or neutral shall; (1); (2); (3); (4); (5). Where run in separate raceways or cables the raceways or cables shall have the same physical characteristics.) Prior to the three exceptions to Section 310-4.
SUBSTANTIATION: New people to the trade and/or just learning to read the code book may miss understand the paragraph and think these rules only have to be followed under Exception No. 3 of paragraph 310-4.

PANEL ACTION: Reject.
PANEL COMMENT: The NFPA Manual of Style requires exceptions to follow the rules they modify.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2217

6- 7 - (310-4, Exception No. 4-(New)): Reject
SUBMITTER: Harry W. Burns, Burns Electric, Inc.
RECOMMENDATION: Revised text:
Exception No. 4: Service Conductors in parallel used in a 120/240 3 phase system shall be permitted to have a single maximum No. 10 Hi Leg Conductor in one conduit.
SUBSTANTIATION: Frequently there is a need to connect a small 3 phase load, under the existing rule, parallel 1/0 conductors would have to be used. The imbalance of 30 Amps or less should create no hazard.

PANEL ACTION: Reject.
PANEL COMMENT: Section 310-4 does not require paralleling of conductors, it permits conductor sizing and permitted installations are covered under other sections of the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:
DURHAM: The Panel comment should have read: Section 310-4 does not require paralleling of conductors, it permits. Conductor sizing and permitted installations are covered under other sections of the Code.

Log # 1147

6- 10 - (310-4 and 310-4, Exception No. 4-(New)): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the first line in the fourth paragraph as indicated:
When "paralleled" equipment grounding conductors are used . . .

After the fourth paragraph, add as indicated:
"Exception: As permitted in Section 300-3(b)."
SUBSTANTIATION: These changes, if approved, will more adequately express the intent of the Code where paralleled or non-paralleled (single) equipment grounding conductors are used. This would, also, ensure the enhancement of safety for life and property.

PANEL ACTION: Reject.
PANEL COMMENT: Substantiation does not support the proposal. Reference is already made to Section 250-95 that states that equipment grounding conductors shall be run in parallel when the other circuit conductors are paralleled. The proposed exception is unnecessary.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3344

6- 9 - (310-4, Exception No. 4-(New)): Reject
SUBMITTER: S. Zackerman, Cincinnati, OH
RECOMMENDATION: Add a new Exception, as follows:
Exception No. 4: Conductors in sizes smaller than 1/0 shall be permitted to be run in parallel for grounded conductors brought to service equipment (Section 250-23(b)), for equipment bonding jumpers on the supply side of service and main bonding jumper (Section 250-79(c)), or for equipment grounding conductors (Section 250-95).
SUBSTANTIATION: This Exception is necessary to resolve the apparent conflict between the sizing rules set forth in Sections 250-23(b), 250-79(c), 250-95 and 310-4.
PANEL ACTION: Reject.
PANEL COMMENT: The Panel does not recognize that a conflict exists as indicated in the substantiation.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 15 - (310-5): Accept

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers AssociationRECOMMENDATION: Refer to Public Comment 6-63 to the proposed 1987 NEC wherein it was recommended that a reference to ICEA Publication P32-382 be added to Section 310-5, and the July, 1986 Standards Council action to refer the issue back to Panel 6 for further study, and take the following action regarding similar proposals for the 1990 NEC:Disallow any reference to ICEA documents P32-382 or PA5-482, which might relate to the withstand rating of insulated conductors, in the National Electrical Code. SUBSTANTIATION: Reference to the ICEA documents should be disallowed on the basis of the ICEA letter from (Name Deleted) dated 3/6/87 (Copy attached) on the subject of "1st Short Circuit Withstand Test Program." This letter clearly states the belief of the authors of the tables (ICEA) that inclusion of those tables in the Code would be inappropriate.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1916

6- 11 - (Table 310-5): Reject

SUBMITTER: Raymond P. Pelletier, City of Auburn, MERECOMMENDATION: Replace 0 AWG with 1/0 AWGSUBSTANTIATION: To correlate with other 1/0 designations.PANEL ACTION: Reject.PANEL COMMENT: Proposal is incorrect. This is already covered by present Code.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2051

6- 12 - (Table 310-5): Accept

SUBMITTER: James M. Daly, The Okonite CompanyRECOMMENDATION: Under the Voltage Rating for 8001 thru 15000 Volts change the minimum conductor size from:

"2 100% Insulation Level"

1 133% Insulation Level"

to read:

"2"

Delete footnote "See Table 310-64, Definitions."

SUBSTANTIATION: Table 310-64 was revised in the 1987 NEC to permit 2 AWG as the minimum conductor size for 15KV 133% insulation level but Table 310-5 was never changed to agree.PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2329

6- 13 - (310-5, FPN-(New)): Reject

SUBMITTER: Vincent Saporita, Villa Ridge, MORECOMMENDATION: Add the following FPN to Section 310-5

(FPN): For conductor short circuit withstand ratings, see International Electrotechnical Commission Publication 364-4-43, Section 434.3.2.

SUBSTANTIATION: Users of the National Electrical Code should be instructed as to where to find information to be able to comply with the short circuit withstand requirements found in Sections 110-10, 240-1 FPN and 250-51(2). The formula found in this publication is accepted "internationally" and will serve to give Code users the direction they need to design and install safe and dependable systems. The cover and section of subject publication are attached for the reader's convenience.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Reject.PANEL COMMENT: Conductor short-circuit ratings should be considered in conjunction with equipment ratings.VOTE ON PANEL ACTION: Unanimously Affirmative.COMMENT ON VOTE:

FRASURE AND SEGALL: Experience with the recommended formula on foreign design jobs has indicated that it is quite conservative. The major concern is that use of the formula will require larger conductor sizes on circuit breakers and similar equipment than the UL approved equipment is designed to handle.

Log # 708

6- 16 - (310-5, FPN-(New)): Reject

Secretary's Note: This was Comment 6-63 on Proposal 6-57 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. It was returned to the Committee for further study by the NFPA Standards Council as the result of a complaint during the processing of the 1987 NEC.

SUBMITTER: J. Ackermann, Belleville, ILRECOMMENDATION: Accept the proposal in principle.

Amend the proposal to reference an IPCEA (ICEA)

Publication. Proposal to read:

(FPN): For conductor short circuit withstand rating, see IPCEA (ICEA) Publication 32-382.

SUBSTANTIATION: The NEC references many industry standards to assist the user of the NEC Section 110-10 does not adequately cover the subject of a conductor's withstand rating since it doesn't reference any industry short circuit standards such as IPCEA (ICEA) Publication 32-382. (See attached as a sample.) I believe that Article 310 is the place to put the requirements since 310 already references IPCEA for ampacities in the footnotes page 181 of the NEC as well as an ampacity formula. Section 310-15 also includes a formula for ampacity. A conductor needs to be sized not only to its published ampacity but also its short circuit withstand rating and the opening time of the overcurrent device. IPCEA (ICEA) Publication 32-382 will provide the necessary information. Since many sections of the Code permit the short circuit overcurrent device to be 3 to 4 times the rating of the conductor such as for motors, equipment grounding, etc., it is necessary that the conductor does not become a hazard under fault conditions.

NOTE: Supporting material available for review at NFPA Headquarters.

PANEL ACTION: Reject.PANEL COMMENT: ICEA suggests that the reference document is not necessarily applicable to all installations.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 659

6- 16A - (310-5, Exception No. 11-(New)): Reject

Secretary's Note: The Correlating Committee directs CMP 6 to act on this proposal on its merits in accordance with Section 60-5 of NEC Operating Procedures. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Dan Leaf, Westlake Village, CARECOMMENDATION: Add:

"Exception No. 11: For electric signs and outline lighting as permitted by Section 600-11(b)."

SUBSTANTIATION: To include the conductors of that section.PANEL ACTION: Reject.PANEL COMMENT: Proposal does not satisfy the requirements of the NFPA Regulations Governing Committee Projects, Part VI, Section 10-10c and d.VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2052

6- 18 - (310-7): Accept

SUBMITTER: James M. Daly, The Okonite CompanyRECOMMENDATION: Change the order of the first two sentences and make two paragraphs to read as follows:

"310-7. Direct Burial Conductors. Conductors used for direct burial applications shall be of a type identified for such use.

Cables rated above 2000 Volts shall be shielded."

The remainder of the Section stays the same.

SUBSTANTIATION: This change will improve the clarity of the Section and be more explicit regarding the intent. The first sentence/paragraph of the revised Section is applicable to all voltages and the second sentence and the remainder of the Section applies only to cables rated over 2000 Volts.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2053

6- 19 - (310-7, Exception-(New)): Reject

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Change "Exception:" to "Exception No. 1:"

Immediately after the existing exception, add "Exception No. 2: The following cables shall be permitted to be direct buried if installed in a system with a grounding conductor that is in close proximity and conforms with Section 250-51.

(a) Shielded multiple-conductor cable with a sunlight-resistant overall jacket and without a grounding conductor.

(b) Shielded single-conductor cable with a sunlight-resistant overall jacket and without a metal sheath or armor."

SUBSTANTIATION: UL 1072 Standard for Medium-Voltage Power Cables, paragraph 71.2, authorizes this type of installation by permitting the tag, reel or carton on these two cable constructions to be marked "For direct burial if installed in a system with a grounding conductor that is in close proximity and conforms with NEC 250-51."

Very few users have ready access to UL Standards or any real need to refer to them. If this type of installation is to be permitted then it should be specifically authorized in the NEC along with the installation requirements.

PANEL ACTION: Reject.

PANEL COMMENT: This section presently recognizes cable types identified for direct burial.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1148

6- 20 - (310-9): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the third line in the first sentence as indicated:

... of a type (suitable) "identified" for the ...
SUBSTANTIATION: The use of the term "suitable" can/does result in an infinite variety of different Code interpretations/actions being used/applied in ways that could cause ineffective, undesirable or disastrous results. It is, therefore, strongly recommended that, in the interest of Code-required levels of safety, compliance and uniformity, the term "identified" (which is defined in Article 100/FPN on page 10) be used because it more adequately defines the requirements needed to ensure the establishment/maintenance of Code-mandated/sanctioned standards that are essential in the safeguarding of persons and property.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-140.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 825

6- 21 - (310-11(a)(2)): Reject

SUBMITTER: Stanley Kaufman, AT&T Bell Laboratories DE

RECOMMENDATION: In 310-11(a)(2) add, Sections 725-41, 761-31, 770-9, 800-5 and 820-4.

SUBSTANTIATION: This proposal corrects an oversight since marking requirements for these sections were added to the 1987 Code.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-22.

VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 22 - (310-11(a)(2)): Accept

SUBMITTER: CMP 6

RECOMMENDATION: Revise Section 310-11(a)(2) to read as follows:

"(2) The proper type letter or letters for the type of wire or cable as specified elsewhere in this Code." Delete the remainder of the paragraph.

SUBSTANTIATION: Effected sections and articles contain the necessary reference.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2938

6- 23 - (310-11(a)(2)): Reject

SUBMITTER: L. Bruce McClung, Union Carbide Corporation

RECOMMENDATION: Add "341" between 340, ____, and last of sentence (2) will then read "and in Article 336, 337, 338, 339, 340, 341 and Section 725-40(b)(3)."

SUBSTANTIATION: New Article 341 "Reduced Emissions Cable Type RE" has been proposed for CMP 7's action. Acceptance of that proposal will necessitate a change in 310-11(a)(2) for marking recognition of a new reduced emissions cable.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-22.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2055

6- 25 - (310-11(a)(2), 310-11(b)(1), 310-11(b)(4)): Accept in Part

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Section 310-11(a)(2): Add "760" to list of Articles referenced.

Section 310-11(b)(1): Add "h. Power-limited fire-protective signaling cable."

Section 310-11(b)(4): Add "e. Power-limited fire-protective signaling cable."

SUBSTANTIATION: Contingent upon CMP16 accepting the proposal to modify Section 760-31 to require marking of Power-limited fire-protective signaling cables in accordance with Section 310-11.

PANEL ACTION: Accept in Part.

Add the following item to the list as follows:

"e. Power-limited fire protective signaling cable."

PANEL COMMENT: The Panel accepts this part of the proposal since only specific cable types may use this optional marking.

The Panel rejects adding Section 310-11(b)(1)h, since it sees no need to individually list the types of cables that fall under the general category of "single and multiconductor" rubber- and thermoplastic-insulated wire and cable."

The Panel rejects adding Article 760 to Section 310-11(a)(2). See Panel Comment on Proposal 6-22.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: I have voted affirmative on these four proposals but my notes say for all of them that the panel action was "accept in part" for the same reasons as given above for proposal 6-28.

Log # 2056

6- 26 - (310-11(a)(2), 310-11(b)(1), 310-11(b)(4)): Accept in Principle

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Section 310-11(a)(2): Add "770" to list of Articles referenced.

Section 310-11(b)(1): Add "h. Optical fiber cable."

Section 310-11(b)(4): Add "e. Optical fiber cable."

SUBSTANTIATION: Contingent upon CMP16 accepting the proposal to modify Section 770-8 to require marking of optical fiber cables, particularly hybrid constructions in accordance with Section 310-11.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Comments on Proposals 6-25 and 6-28.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: Same as Proposal 6-25.

Log # 2057

6- 27 - (310-11(a)(2), 310-11(b)(1), 310-11(b)(4)):
Accept in Principle

Secretary's Note: See Correlating Committee action on Proposal 6-28.

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Section 310-11(a)(2): Add "800" to list of Articles referenced.

Section 310-11(b)(1): Add "h. Communications cable."

Section 310-11(b)(4): Add "e. Communications cable."

SUBSTANTIATION: Contingent upon CMP16 accepting the proposal to modify Section 800-5 to require marking of communication cables in accordance with Section 310-11.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Comments on Proposals to 6-25 and 6-28.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: Same as Proposal 6-25.

Log # 2054

6- 28 - (310-11(a)(2), 310-11(b)(1), 310-11(b)(4)):
Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 16-54. This action will be considered by the Panel as a Public Comment.

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Section 310-11(a)(2): Change ". . . and Section 725-40(b)(3)." to read ". . . and 725."

Section 310-11(b)(1): Change "g. Power-limited tray cable." to read "g. Class 2 and 3 Power-limited cables."

Section 310-11(b)(4): Change "d. Power-limited tray cable." to read "d. Class 2 and 3 Power-limited cables."

SUBSTANTIATION: Contingent upon CMP16 accepting the proposal to modify Section 725-41 to require marking of Class 2 and all Class 3 power-limited cables in accordance with Section 310-11. Section 725-40(b)(3) currently requires marking of only Class 3 Type PLTC cables in accordance with Section 310-11.

PANEL ACTION: Accept in Principle.

Rewrite Section 310-11(b)(1) to read as follows:

"(1) Surface Marking. Single and multiconductor rubber- and thermoplastic-insulated wires and cables shall be durably marked on the surface at intervals not exceeding 24 inches (610 mm)."

Revise present Code text in Section 310-11(b)(4)d to read as follows:

"d. Class 2 and 3 power-limited cables."

The Panel rejects the change to Section 310-11(a)(2).

PANEL COMMENT: See Panel Comment on Proposal 6-22.

The Panel rejects the change to Section 310-11(b)(1), see Panel Comment on Proposal 6-22.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: I have voted affirmative on the panel action to accept in principal this proposal. However, my notes at the meeting say that the panel action was "accept in part" with the following panel recommendations and panel comment.

Panel recommendations:

1. Proposed Section 310-11(a)(2). - Reject
2. Reference Section 310-11(b)(1). Rewrite section as follows: Surface marking. Single and Multiconductor rubber and thermoplastic insulated wires and cables shall be durably marked on the surface at intervals not exceeding 24 in. (610 mm).
3. Reference Section 310-11(b)(4). Accept as proposed.

Panel Comment:

1. Section 310-11(a)(2). See panel comment for Proposal 6-22.

2. Section 310-11(b)(1). The panel rejects this part of the proposal since it sees no need to individually list the types of cables that fall under the general category of, "single and multiconductor rubber and thermoplastic - insulated wires and cables."

3. Section 310-11(b)(4) - The panel accepts this part of the proposal since only specific cable type may use this optional marking.

Log # 2058

6- 29 - (310-11(a)(2), 310-11(b)(1), 310-11(b)(4)):
Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 16-215.

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Section 310-11(a)(2): Add "820" to list of Articles referenced.

Section 310-11(b)(1): Add "h. Community antenna television and radio distribution cable."

Section 310-11(b)(4): Add "e. Community antenna television and radio distribution cable."

SUBSTANTIATION: Contingent upon CMP16 accepting the proposal to modify Section 820-4 to require marking of communication cables in accordance with Section 310-11.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Comments on Proposals 6-25 and 6-28.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: Same as Proposal 6-25.

Log # 2059

6- 24 - (310-11(a)(5)-(New)): Reject

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Add new section to read as follows:

"(5) The LC₅₀ in grams for the nonmetallic content of the insulated wire or cable.

(FPN): One method of determining the LC₅₀ value is by testing the insulated conductor or cable to the Combustion/Toxicity Testing requirements of the Codes, Rules and Regulations of the State of New York, Title 9 (Executive Department), Subtitle S (Division of Housing and Community Renewal), Part 1120, Section 1120.7 Procedure for evaluation of acute toxicity resulting from exposure of mice to thermal decomposition products using a modification of the protocol developed at the University of Pittsburgh."

SUBSTANTIATION: This additional information will permit the designer, installer and user to know the relative toxicity of the insulated wire and cable products being installed. This subject is becoming increasingly more important and since it is directly applicable to electrical installations, the NEC should be the leader and establish a national requirement. The New York State law requires registration of this same data with the New York Secretary of State by Dec. 16, 1987. Numerous other states are considering similar laws and inclusion of this requirement in the NEC will provide consistency for all the states and establish a uniform national requirement.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel is unaware of any nationally recognized testing procedures to establish these values.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: McClung.

EXPLANATION OF VOTE:

MCCLUNG: My negative vote is based on the "need to know" in some situations as "TSCA" and "SARA" Acts have dictated the "right to know" the potential toxicity effects of commonly utilized consumer products. The panel can at least indicate support for such a proposal and request the NFPA TAC to provide directions for a nationally recognized testing procedure to establish LC₅₀ values.

Log # 826

6- 30 - (310-11(b)(1)): Accept

SUBMITTER: Stanley Kaufman, AT&T Bell Laboratories/DE

RECOMMENDATION: Increase the maximum marking interval from 24 inches to 40 inches.

SUBSTANTIATION: There are many marking requirements for cable, the familar Underwriters Laboratories and Canadian Standards Association requirements as well as new requirements from New York State. We need more room for these messages. The Canadian Standards

Association is changing their requirements to permit one meter intervals. This proposal would harmonize UL and Canadian requirements.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Craig.

EXPLANATION OF VOTE:

CRAIG: To increase marking of cable from 24" to 40" would only make it more difficult for inspectors and wireman to determine wire size in new and existing installations.

Log # 1015

6- 31 - (310-11(b)(1)): Reject

SUBMITTER: George J. Johnson, Shaker Heights, OH

RECOMMENDATION: Revise as follows:

(1) Surface Marking. The following conductors and cables shall be "legeable" and durably marked on the surface at intervals not exceeding 24 inches (610 mm):
SUBSTANTIATION: Almost all of the NM cable and some of the UF Cable are embossed and in difficult light conditions are impossible to identify as to type, lighting and size. If these cables would be identified by contrasting colored ink markings, rough-in inspections of installed cable would be made positive and more effective.

PANEL ACTION: Reject.

PANEL COMMENT: Present Code requires durable marking.

If legibility is a problem, the manufacturer and certification agency should be consulted.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1778

6- 32 - (310-11(b)(2), Exception No. 3): Accept

SUBMITTER: Austin Wetherell, Underwriters Laboratories, Inc.

RECOMMENDATION: delete "(1), (2), and (4) above"

SUBSTANTIATION: There seems to be no reason why item (3)- manufacturer's I.D.- could not be permitted on the outer surface as well. The present wording requires a marker tape for the manufacturers I.D. even if the balance of the items are surface printed. This seems unnecessary in view of the improvement in surface printing methods that have occurred in recent years.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1149

6- 33 - (310-12(a) and Exception No. 5): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second lines of the first and second sentences in (a) and the second line in Exception No. 5 as indicated:

... for use as grounded "(neutral)" conductors of circuits ...

... installation, grounded "(neutral)" conductors ...

SUBSTANTIATION: This change is needed to more adequately clarify and simplify the Code meaning/intent because, in accordance with this Code, the neutral and the grounded conductor performs the same/similar functions as indicated in Sections 230-31(c) and 230-42(c). Also, this would do much to minimize confusion and misapplication because in some Code sections the term "neutral" is used and in other sections the term "grounded conductor" is used; for example, in Section 200-2 "grounded conductor" is used and in Section 210-4 "neutral" is used.

PANEL ACTION: Reject.

PANEL COMMENT: Not all grounded conductors are neutrals.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3463

6- 34 - (310-12(b), Exception No. 1): Reject

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Revise as follows:

Exception #1. An insulated or covered conductor larger than "No. 10" shall at the time of installation be permitted to be permanently identified as a grounding conductor at each end and at every point where the conductor is accessible, identification shall be accomplished by one of the following means - a.b.c. (same)

SUBSTANTIATION: Many times #6 and #8 wire are not available in green or green with a yellow stripe. However, the contractor cannot re-identify a conductor green or cannot use a bare #6 or #8 when smaller than #4 wire. This would help alleviate some of the lawsuits, since it is common practice to re-identify or strip bare the exposed wire on sizes #6 and #8 wire.

PANEL ACTION: Reject.

PANEL COMMENT: There are presently green-colored insulated conductors up through No. 6 AWG readily available.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 660

6- 35 - (310-12(b), Exception No. 2): Reject

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert "No. 6 awg or smaller" between "conductor" and "in".

SUBSTANTIATION: Since Exception No. 1 of (b) permits the same identification methods for No. 4 or larger conductors without regard to conditions of maintenance or supervision it should be applicable whether or not the conductor is part of a multiconductor cable. It appears to be more reasonable to apply the restrictions of maintenance and supervision to smaller conductors of multiconductor cables. The present wording does not make this distinction.

PANEL ACTION: Reject.

PANEL COMMENT: The substantiation does not support the proposal and the present wording of Exception No. 2 agrees with the last sentence of the substantiation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3098

6- 36 - (310-12(c), Exception-(New)): Reject

SUBMITTER: Ivan J. De Witt, Holland, MI

RECOMMENDATION: Revise the text in part to include reference to an exception which permits the use of a white colored wire as an ungrounded conductor.

Except as permitted by Section 200-7 Exception 2, ungrounded conductors shall be distinguished by colors other than white, natural gray, or green; or by a combination of color plus distinguishing marking.

SUBSTANTIATION: Conflict exists between Section 300-12(c) and the permitted use of the white colored wire in Section 200-7 Exception 2 as an ungrounded conductor in a 3-way or 4-way switch loop.

PANEL ACTION: Reject.

PANEL COMMENT: Panel does not agree that there is a conflict between Sections 310-12(c) and 200-7, Exception No. 2 and believes it is unnecessary to cross reference it in the Code.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 110

6- 37 - (310-12(c), Exception-(New)): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Add exception (new) after Section 310-12(c) as indicated:

"Exception: As permitted in Section 200-10(d) for the ungrounded conductor."

SUBSTANTIATION: This change is needed to clarify the Code conflict between Section 200-10(d) and Section 310-12(c).

PANEL ACTION: Reject.

PANEL COMMENT: The Panel sees no conflict between Sections 200-10(d) and 310-12(c).

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2060

6- 46 - (310-13, FPN-(New)): Reject

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Add a second fine print note to read:

"(FPN): Thermosetting insulation should be used for dc circuits in wet locations. Electrosmosis caused by continuous exposure to dc voltage in wet locations will cause insulation failure in many thermoplastic insulating materials."

SUBSTANTIATION: There is no cautionary note anywhere in the NEC regarding the potential failures that can occur when thermoplastic insulating materials are used on dc circuits in wet locations. While this potential problem has existed for many years, not many users are aware of it. For example, some of the newer gas detectors use higher dc voltage levels which accelerates the thermoplastic insulated cable failure and could create a hazardous situation. Thermosetting insulations are not adversely effected by dc voltage in wet locations.

PANEL ACTION: Reject.

PANEL COMMENT: Lack of sufficient substantiation. Not all thermoplastics react in this manner.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: McClung.

EXPLANATION OF VOTE:

MCCLUNG: My negative vote is being made because I have on several occasions observed the electroendosmosis effect creating a "green goo ooze" that will come out of many thermoplastic insulation conductors and drip or run down over terminals or electrical equipment where the cable enters from above. A FPN is a good way to warn others to take steps to avoid this not uncommon problem.

Log # 114

6- 47 - (310-13, FPN): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the Second line of the First sentence in the FPN as indicated:

... requiring "that" care be exercised ...

SUBSTANTIATION: Editorial - to correct grammatical error.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1780

6- 38 - (Table 310-13): Accept

SUBMITTER: Austin D. Wetherell, Underwriters Laboratories, Inc.

RECOMMENDATION: In the column headed "Outer Covering", add "*****"

At the bottom of the table (side of Page) add:
"*****" Some insulations do not require an outer covering"

SUBSTANTIATION: The non-jacketed constructions were permitted, prior to the 1981 NEC, via the reference to 338-1(b). In 1981, the "insulations approved for the purpose" statement was deleted from 338-1(b). It appears to have been deleted during an editorial re-write since no proposal to revise section 338-1(b) was found in the TCR and TCD. The footnote needs to be put in Table 310-13 to be consistent with, eg. Type RHW which has a similar footnote.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1991

6- 39 - (Table 310-13): Accept

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading on each page.

SUBSTANTIATION: The correct designation for the area of a conductor is cmil (circular mil) or kcmil (1,000 circular mils) and should be used when defining conductors larger than 4/0 AWG. "M" is the Roman designation for 1,000 while "k" is the English designation.

ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms, includes circular mil and all new IEEE Standards use the kcmil designation. Underwriters Laboratories and the Insulated Cable Engineers Association (ICEA) have also changed from the MCM designation to kcmil. It is important for consistency that the NEC also change to the kcmil designation.

Similar proposals are being submitted for all effected Sections of the NEC.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2061

6- 40 - (Table 310-13): Accept

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Add a new conductor type to the Table.

Trade Name:	Moisture- and Heat-Resistant Rubber
Type Letter:	RHW-2

Max. Operating Temp.:	90C 194F
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Application Provisions:	Dry and wet locations
-------------------------	-----------------------

Insulation:	Moisture- and Heat-Resistant Rubber
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Thickness of Insulation:	same as for Type RHW in existing Table
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Outer Covering:	same as for Type RHW in existing Table
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SUBSTANTIATION: Some Moisture- and Heat-Resistant Rubbers are suitable for a continuous conductor operating temperature of 90C (194F). Rubber insulation compounds, such as ethylene-propylene rubber (EPR) have been tested and proven satisfactory at 90C in wet locations when tested in accordance with ICEA T-22-294, Test Procedures for Extended Time Testing of Wire and Cable Insulations for Service in Wet Locations. These insulation compounds have been used at 90C in wet locations for many years by electric utilities without any failures or problems. These thermosetting insulation compounds are in the same chemical family as the insulation compounds used for Type MV-90 cables for 5 to 35kV at 90C wet or dry. It is not logical to permit medium voltage cables, which operate under much greater electrical stress, to operate at 90C in wet locations and restrict 600V insulated conductors to 75C in wet locations. Addition of this new conductor type will permit Underwriters Laboratories and other recognized testing laboratories to establish test programs to qualify insulation compounds for 90C operation in wet locations.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Straniero.

EXPLANATION OF VOTE:

STRANIERO: The substantiation submitted with this proposal is inadequate for including a conductor type with a new, higher temperature rating for use in wet locations in the code. The submitter has not provided any independent laboratory test data for evaluation by the panel.

Since the 90 C wet rating is new to the code, there are no established requirements for a recognized listing laboratory to compare the new construction against. Accordingly, a fact finding report for such a construction must be submitted to the code panel for review and evaluation.

COMMENT ON VOTE:

COFFEY: In Type MV cable the insulation is usually covered by a shield and/or jacket whereas for building wire the insulation is usually not covered. This could require different insulation requirements for the 90 C wet rated building wire vs the 90 C wet rated MV cable.

Log # 2062

6- 41 - (Table 310-13): Accept

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Add a new conductor type to the Table.

Trade Name:	Moisture- and Heat-Resistant Cross-Linked Synthetic Polymer
Type Letter:	XHHW-2
Max. Operating Temp.:	90C 194F
Application Provisions:	Dry and wet locations
Insulation:	Flame-Retardant Cross-linked Synthetic Polymer
Thickness of Insulation:	same as for Type XHHW in existing Table
Outer Covering:	None

SUBSTANTIATION: Flame-retardant Cross-Linked synthetic polymers (XLPE) are suitable for a continuous conductor operating temperature of 90C (194F). XLPE insulation compounds have been tested and proven satisfactory at 90C in wet locations when tested in accordance with ICEA T-22-294, Test Procedures for Extended Time Testing of Wire and Cable Insulations for Service in Wet Locations. These thermosetting insulation compounds are in the same chemical family as the insulation compounds used for Type MV-90 cables for 5 to 35kV at 90C wet or dry. It is not logical to permit medium voltage cables, which operate under much greater electrical stress, to operate at 90C in wet locations and restrict 600V insulated conductors to 75C in wet locations. Addition of this new conductor type will permit Underwriters Laboratories and other recognized testing laboratories to establish test programs to qualify insulation compounds for 90C operation in wet locations.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Straniero.

EXPLANATION OF VOTE:

STRANIERO: Same as Proposal 6-40.

COMMENT ON VOTE:

COFFEY: Same as Proposal 6-40.

Log # 2448

6- 42 - (Table 310-13): Accept

SUBMITTER: Barry O'Connell, Pyrotenax of Canada Limited

RECOMMENDATION: Under "Outer Covering" for "Mineral Insulated (metal sheathed)" Type "MI", change to read . . . "Copper or Alloy Steel."

SUBSTANTIATION: N.E.C. only recognizes copper-sheathed copper-conductor M.I. cable. M.I. cable is now produced with a nickel-alloy sheath and nickel-clad copper conductors. (This proposal is made in conjunction with associated proposals on Articles 330-20, 330-22, and 330-1. The application of this cable ("SSMI") is in corrosive environments where an extremely high fire withstand capability is required. The alloy sheath provides a high degree of corrosion resistance; The Nickel cladding on the copper conductors provides a high temperature withstand ability to temperatures in excess of the melting point of copper.

SSMI is used primarily in critical circuits in high fire-risk areas in the petrochemical industry, and in applications where corrosion resistance is a requirement. It successfully withstands the UL 2-hour fire test (tests performed August '87; UL letter attached). It has been the subject of a Fact-Finding report by UL, which is in progress and will be completed and submitted as an addendum to this proposal before year-end.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2939

6- 43 - (Table 310-13): Accept in Principle

Secretary's Note: The Correlating Committee directs that this proposal be referred to the NFPA Committee on the Toxicity of the Products of Combustion for comment.

SUBMITTER: L. Bruce McClung, Union Carbide Corporation

RECOMMENDATION: In the Column designated as "Type Letter" place a "+" adjacent to the types MTW, RHH, RHW, SIS, THHN, THW, THWN, TW, and XHHW. Put a "+" footnote at the appropriate place at the bottom of the table to read:

"Insulations and outer coverings that meet the requirements of Article 341 and are so listed, can be designated Reduced Emissions with the suffix /RE marked with the Type Letters, i.e., THHN/RE certifies that it is THHN with reduced emissions and may be used in occupancies as covered in Articles 517, 518, 520, 530, 620, 645, and 685."

SUBSTANTIATION: Various proposals will call for changes in the use of synthetic materials used in wire and cable construction. The use of compounds that give off low smoke during pyrolysis or combustion provide substantial improvement in fire safety for places of assembly. Also, firefighters can more easily and safely locate and extinguish a fire source.

The proposal will create designations of insulations that provide acceptable emission levels and allow selection of, and inspection of, a suitable cable for a given occupancy.

Smoke and the hazards associated with smoke are increasingly relevant factors in public awareness of fire safety. The MGM Grand, Beverly Hills Super Club, and the Yonkers Department Store fires are recent examples of fires resulting in fatalities attributed to smoke. Other fires, such as the riser cable fire at the World Trade Center produced extensive smoke and property damage and could have resulted in personal injury had it occurred at high occupancy times. Smoke obscures vision. Smoke irritates and corrodes. Smoke impedes safe egress. Smoke contributes to victim disorientation, excitation and incapacitation. Statistics from several sources including the U.S. Fire Administration; M. Birky's, "Fire Fatality Study, FIRE MATERIAL, 1979, 3:211-217; and J. Loke and R. A. Matthey's, "Managing Victims of Smoke Inhalation," JOURNAL OF RESPIRATORY DISORDERS, 1981, 2:87-98, show that 70 to 80% of fire victims actually succumb from smoke inhalation, not the fire itself.

In "Measuring Hazards of Products of Combustion from Electrical Systems," FIRE JOURNAL, September/October 1987, pp 108-109, J. E. Snell illustrates several examples of potential fire scenarios that may produce smoke toxicity hazards, as reiterated in Table 1. This article makes an interesting point: "even though electrical systems account for only a small fraction of the total mass of materials in a building, they may be among the items significantly involved in a fire." It follows, therefore, that even when generic materials are commonly used in building furnishings such as wall coverings and furniture, their performance and hazards nonetheless may need to be judged under separate, more stringent criteria when used in electrical applications.

Occupancies of concern include places of assembly such as high-rise commercial and hotel buildings, industrial and hospital electrical and computer control rooms, theaters, schools, nursing homes, and shopping centers.

Communications, Class 1, Classes 2 and 3 remote control, signaling, power limited circuits, and cables whose use in air-handling plenums is governed by Articles 725, 760, and 800, are required to pass the NFPA 262 1985 test for flame spread and smoke emission. This is a very severe test because the cables so classified are installed directly in environmental air systems. However, there are no flame-spread or smoke requirements for many power and

control cables which are installed in "open" areas other than environmental air-handling plenums, i.e., not afforded the protection of fire barriers such as gypsum board or metal enclosures. Despite the fact that these wires and assemblies are not involved in environmental air handling systems, they do pose a smoke hazard as evidenced in the above fires.

Large- and small-scale flame spread and smoke tests performed on the types of cables being suggested for designation as reduced emissions have demonstrated a definite smoke hazard.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept in Principle.

Revise the proposal to read as follows:

"Insulations and outer coverings shall be permitted to be designated limited smoke with the suffix LS. For example THHN/LS identifies that this conductor is THHN with limited smoke characteristics."

PANEL COMMENT: The Panel believes that the Panel's wording satisfies the submitter's request.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Durham, Straniero.

EXPLANATION OF VOTE:

DURHAM: The Aluminum Association could not reach a consensus opinion on this proposal.

STRANIERO: The substantiation submitted with this proposal is inadequate for adding new wire types in the code. No independent laboratory test report has been submitted to support what constitutes limited smoke or what tradeoffs, if any, (as noted in the substantiation for this proposal) are acceptable.

A technical report, i.e., UL fact finding report, that addresses these issues must be submitted to the code panel for review and evaluation.

COMMENT ON VOTE:

COFFEY: Same comment as for Proposal 6-173.

SUBSTANTIATION: This new specification would provide a singular alternate product for most present uses of MTW, THW, THHN, THWN, and XHHW excepting where oil and gasoline resistance is required.

Nylon is highly susceptible to moisture absorption both during manufacturing and in the field. This causes extreme degradation of the physical properties. Nylon is also easily damaged by wrinkling, nicks, cuts, and tears during installation.

This product would combine the desirable features of the higher 90°C temperature rating (dry location) with the greater wall thickness. It would also eliminate the problems inherent with a nylon outer coverings.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1779

6- 45 - (Tables 310-13, 310-16, 310-17, 310-18, 310-19, 310-67; Chapter 9, Table 7): Accept in Principle

SUBMITTER: Austin D. Wetherell, Underwriters Laboratories, Inc.

RECOMMENDATION: Delete reference to A, AA, AI, AIA, AVA, AVB, and AVL in Tables 310-13, -16, -17, -18, and -19. Delete entire Table 310-67 and Chapter 9, Table 7.

SUBSTANTIATION: UL has withdrawn Listings of these Types since they are no longer manufactured. Standard UL 115 has been withdrawn as well.

PANEL ACTION: Accept in Principle.

Add "Section 310-15" to the list in the proposal.

PANEL COMMENT: To correlate with Proposal 6-49.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2835

6- 44 - (Tables 310-13, 310-16, 310-17, 310-22, 310-23, 310-25, 310-26, 310-27, 310-28; Chapter 9 Tables 3A, 3B, 5, 5A; 310-8, 310-14, 410-31, and 620-11(d)): Accept

SUBMITTER: Phil Pringle, Capital Wire and Cable Corporation

RECOMMENDATION: Addition to Table 310-13

Trade Name	Type Letter	Max. Operating Temp.	Application Provisions	Insulation	AWG or MCM	Thickness Mils Of Insulation	Outer Coverings
Moisture and Heat Resistant Thermo-plastic	THHW	75°C	Wet Location	Flame Retardant	14-10	45	None
		90°C	Dry Location	Moisture and	8-2	60	
				Heat Resistant	1-4/0	80	
				Thermoplastic	213-500	95	
					501-1000	110	

ADD:

"THHW" designation to the "75°C" and the "90°C" columns of the following tables:

310-16

310-17

310-22

310-23

ADD:

"THHW" designation to all column headings in tables:

310-25

310-26

310-27

ADD:

"THHW" designation to all columns and line items presently containing the "THW" designation in the following tables of Chapter 9:

3A

3B

5

5A

ADD:

"THHW" designation to the following paragraphs and any others that contain specific reference to "THW, THWN, and XHHW" as a generalized grouping:

310-8

310-14

410-31

620-11D

6- 48 - (310-14): Accept

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: In the fourth line, change "MCM" to "kcmil".

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 49 - (310-15):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

The Correlating Committee is compelled to respond to some of the comments expressed in the voting because of the sharp division in voting positions within CMP 6 and the statements being made therein that may be influencing the voting positions.

The Correlating Committee believes it is harmful to the purpose of the Code when positions are based on opinions that Article 220 does not apply to commercial and industrial installations.

1. The comments expressed state that, "It is true that most loads calculated where underground failures occurred were not calculated by Article 220, but there is a good reason for this. Article 220 in its present form does not cover modern commercial and industrial load calculations." The Correlating Committee's position is that Article 220 applies.

2. The comments expressed in the voting suggest that the correct solution to resolving the incompatibility problem between the Neher/McGrath ampacity tables and Article 220 "is for the NEC to be correct in both the load calculations and the underground ampacity ratings." The Correlating Committee wishes to point out that CMP 2 action is not supportive of the above comments as evidenced by their rejection of Proposal 2-229. See Correlating Committee action on Proposal 6-61.

CMP 6 has set up a Panel Subcommittee to propose alternate solutions and the Correlating Committee agrees with this approach.

The Correlating Committee also wishes to advise CMP 6 that FPN No. 1 contains a recommendation which is a violation of Section 110-1 and the NEC Style Manual. Fine Print Notes can only contain explanatory material.

SUBMITTER: CMP 6

RECOMMENDATION: Revise Section 310-15 as follows:

310-15. Ampacity. Ampacities for conductors rated 0 through 2000 volts shall be as specified in Tables 310-16 through 310-24 and 310-31 and their accompanying notes or shall be permitted to be calculated under engineering supervision using the following general formula:

$$I = \sqrt{\frac{TC}{RDC (1 + YC) RCA}}$$

TC = Conductor temperature in degrees C.

TA = Ambient temperature in degrees C.

DELTA TD = Dielectric loss temperature rise.

RDC = DC resistance of conductor at temperature TC.

YC = Component ac resistance resulting from skin effect and proximity effect.

RCA = Effective thermal resistance between conductor and surrounding ambient.

(FPN): Ampacities may be calculated under engineering supervision as defined in the basic ampacity paper "The Calculation of the Temperature Rise and Load Capability of Cable Systems" by J. N. Neher and M. H. McGrath, IEEE No. 57-660.

The ampacity for Types V, AVA, AVB, and AVL conductors rated 2001 through 5000 volts shall be the same as for those conductor types rated 0 through 2,000 volts, the ampacities for solid dielectric insulated

conductors rated 2001 through 35,000 volts shall be as specified in Tables 310-69 through 310-84 and their accompanying notes.

The term electrical duct(s) as used in Article 310 shall include any of the electrical conduits recognized in Chapter 3 as suitable for use underground; and other raceways, round in cross section, listed for underground use; embedded in earth or concrete.

When more than one calculated or tabulated ampacity applies to a given circuit length, the lowest value shall be used.

(FPN No. 1): Where an underground installation consists of more than 9 current-carrying conductors, in close proximity, consideration should be given to conductor operating temperature in applying the ampacity values of Table 310-16.

(FPN No. 2): The ampacities provided by this section are based on temperature alone and do not take voltage drop into consideration.

(FPN No. 3): Conductors of circuits as defined in Article 100, sized to prevent a voltage drop exceeding 5 percent, will provide reasonable efficiency of operation.

In Figure 310-1 of the Code delete Note 2 of Notes to Details.

Change heading to:

Figure 310-1. Cable Installation Dimensions for Use with Tables 310-77 through 310-84.

Add extended temperature correction factors to Table 310-16 as follows:

(Material shown below.)

Change heading of Table 310-16 to:

"Table 310-16. Ampacities of Not More Than Three Single Insulated Conductors, Rated 0 through 2000 Volts, in Raceways or Cable or Directly Buried and Ampacities of Cable Types AC, NM, NMC, and SE Based on Ambient Air Temperature of 30°C (86°F) and Load Calculations Under Article 220."

SUBSTANTIATION: This is a CMP 6 generated proposal to address the concerns of several proposals submitted on the subject of ampacities and to provide two methods for determining ampacities of conductors installed underground.

Two new Fine Print Notes are added to provide a reference for calculating ampacities under engineering supervision and to provide guidance on the utilization of Table 310-16 for underground installations.

Users are cautioned that the use of Table 310-16 is predicated on load calculations under Article 220.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: I am in total agreement with that portion of the Panel action to allow Table 310-16 to be used to determine the ampacities of conductors in underground installations. I am voting against that portion of the Panel action to delete Tables 310-25 through 310-30. I do agree that for many reasons, some good - some not so good, Tables 310-25 through 310-30 were confusing and simply not adequate for numerous routine installations, and therefore, were not accepted by many jurisdictions. That is why I supported TIA #249 to provide relief in this area until the 1990 Code changes can be processed.

In addition, I also agree with the Panel actions to:

- o Require load calculations to be made under Article 220 when using Table 310-16.

- o Provide guidance on the utilization of Table 310-16 for underground installations.

- o Provide a reference for calculating ampacities under engineering supervision.

- o Provide two methods for determining ampacities of conductors installed underground. (Table 310-16 and Neher-McGrath [N.M.])

Ambient Temperature	60°C	75°C	85°C	90°C	60°C	75°C	85°C	90°C
6-10	1.29	1.20	1.17	1.15	1.29	1.20	1.17	1.15
11-15	1.22	1.15	1.13	1.12	1.22	1.15	1.13	1.12
16-20	1.15	1.11	1.09	1.08	1.15	1.11	1.09	1.08
21-25	1.08	1.05	1.04	1.04	1.08	1.05	1.04	1.04

My disagreement exists because I don't think the Panel went far enough. Without Tables 310-25 through 310-30, anyone choosing to use the N.M. method must start from scratch and calculate all ampacities. At best, the N.M. calculations can be complex and most difficult - even for an experienced electrical engineer. In reality, for the N.M. method to be considered a viable and reasonable alternative to Table 310-16, the tables are necessary and should be published in the N.E.C.

During the course of this Code cycle, we received a lot of construction input from the field. People have been very concerned about the underground ampacity tables, and I think the Panel did address most of their concerns. While this Code is written for and used by all segments of society - residential, commercial and industrial - it is the industrials and large commercials that are most likely to choose the N.M. method to determine U.G. conductor ampacities. By deleting the tables, I feel that Panel 6 failed to adequately address the concerns of this large segment of the user community.

There were arguments presented about whether or not the tables were technically correct, safe and properly applied. Those same arguments are valid for ANY of the ampacity tables, including Table 310-16. In my opinion, when all the variables are identified, properly evaluated and applied, the conductor ampacities derived from using the N.M. method will provide a safe, reliable, and properly sized installation.

The N.M. method would provide a realistic alternative to using Table 310-16. If Panel 6 will reinstate the Tables and accept the proposals required to expand their applicability, I could then accept the Panel action in its entirety.

FRASURE AND SEGALL: This is undoubtedly the most misleading and technically incorrect proposal ever made by a code making panel. The original version was even worse, calling for the elimination of Table 310-1, which would have invalidated the high voltage underground tables. It did not provide for ambient corrections below 210°C if Table 310-16 were used underground, and did not point out that Table 310-16 would only work underground for small numbers of conductors, where the load current was overestimated by 250-300% by using Article 220 for the load calculation.

However, the whole thing is still a misapplication that depends on overestimating the load by 200-300% using Article 220 in order to have a prayer of working. We don't need things like this is the Code.

As we all learned in the second grade, zero multiplied by any number, no matter how large or how many times, is still zero. This proposal is a zero, no matter how many people have approved it and no matter what their status is. I think I can satisfy any thinking person that this is true within the next few paragraphs.

1. First, a little history for those who are new to the issue. Shortly before 1975 NEC, OSHA mandated the use of the National Electrical Code. It is now the recognized tool for all electrical design including industrial, commercial, housing, etc. Thus the Code has to be usable by all of us, not just a selected few. Also, it must be technically correct. Prior to this time, I have never seen my Panel willing to sacrifice the technical integrity of the Code.

2. The new tables were installed in the Code because of recorded underground burnouts using prior-to-1984 ampacities. These burnouts were of two types: (1) caused by electrical designers who did not know that 310-16 was not applicable to underground ampacities, and (2) electrical designers who did not know that high voltage ampacity tables were only good for the spacing shown in Figure 310-1.

3. No opponents of the new tables showed any interest in reviewing these failures because they were admittedly not calculated by Article 220. Thus they were actual loads, not pseudo loads. For most industrial and many commercial applications (such as Wendy's and Burger King, etc.) the demand loads and load factors are very precisely known through history or else can be precisely calculated (as in the case with large rectifier installations and process plants). For most large process plants we find that KW

per pound of product with load and power factors determined by history to be the best criteria. These criteria result in ACTUAL loads. The NEC tables MUST be able to handle this. The purpose of the Code is to prevent you from making mistakes, NOT to lead you into them.

4. The Panel proposal says, in effect, that all underground ampacities are the same - regardless of the number of circuits, the thermal paths, the spacing, etc. This is obviously ridiculous. Look at any underground ampacity table. The ampacity goes down dramatically as the number of circuits is increased because of mutual heating - the closer the spacing, the more deduction. To ignore this is like trying to repeal the law of gravity.

5. From the attached sheets it can be seen that there is some correlation between a single 3-1/c circuit in conduit in air and a single 3-1/c circuit in an underground duct. But, due to mutual heating, as soon as a second and subsequent circuits are added, it is no longer the ampacity of all circuits. The result, without some fixed criteria, is ALWAYS unknown ampacities at an unknown load factor.

6. One of the most difficult items to understand is the complaint of opponents of the existing underground tables that if the spacing is changed, the ampacity changes. Surely they must understand that the same thing is true of the Panel proposal, only in this case nobody knows what the actual ampacity is. Talk about flying blind!

Inconsistencies in the Panel proposal are rampant. This proposal says that one ampacity is good for all underground applications regardless of the number of circuits, circuit spacing, circuit enclosure, or earth thermal resistivity. Yet on Proposal 6-133 the Panel admits that Figure 310-1 is necessary to preserve the integrity of the high voltage ampacity tables. Just because the voltage changes to 0-2000 volts, this doesn't invalidate all the laws of thermodynamics!

Another unusable part of the proposal is where it states, "Where an underground installation consists of more than 9 current carrying conductors, in close proximity, consideration should be given to conductor operating temperature in applying the ampacity values of Table 310-16." What do you do if you have more than nine conductors? What is close proximity? How can the user possibly know what the operating temperature will be? How was the number of conductors determined? I'll tell you. It was grabbed out of the air by a group of people who finally realized that their proposal was seriously flawed. There is no scientific basis for any of this.

It is true that most loads calculated where underground failures occurred were not calculated by Article 220, but there is a good reason for this. Article 220 in its present form does not cover modern commercial and industrial load calculations. It covers dwelling units, hospitals, hotels, farms, and schools. It does not specify load calculations for shopping centers, large commercial buildings, and industrial facilities. It is totally inadequate for calculating equipment loads with complicated cooling and heating cycles, variable speed motor drives, uninterruptable power supplies, variable voltage cell lines, etc., etc. Therefore the user is forced into making his load calculations in accordance with some more usable document such as IEEE Std. 241. These calculations approximate the true load instead of being two or three times the ampacity of the load as it normally obtained by a literal interpretation of Article 220.

Now, when the users turn to Article 310 of the NEC to determine underground ampacities, they are using actual loads instead of pseudo loads that are only 30-50% of the actual load. Many of these loads often have close to 100% load factor. THEREFORE THE AMPACITY TABLES HAVE TO BE ABLE TO HANDLE THESE TRUE LOADS.

The Code proposals under discussion all have one basic premise - if you calculate the loads by Article 220, the load will be so much higher than the actual load that it will compensate for the misuse of Table 310-16 in underground applications. This is a case of hoping one error will compensate for another. It is not scientific, won't work all the time, and equates to voodoo magic. Certainly it should not be a part of the NEC.

7. The NEC, to the best of my knowledge, has never originally accepted ampacity tables where either the calculations or the formulae for making the calculations were not specified. Some of the tables have been misapplied after original acceptance, but this has now been corrected.

No method of calculation is submitted to substantiate the proposed ampacities. THERE IS A GOOD REASON FOR THIS ALSO - you can't calculate the proposed ampacities by any known method. The method by which the ampacities in Table 310-16 were calculated is for three single conductors in a conduit in free air. It was never intended for underground use, and utilizes none of the parameters recognized by engineers the world over as being necessary to determine underground ampacities.

8. It is simply NOT TRUE that load factor cannot be estimated prior to constructing an installation. These factors are routinely utilized based upon history and calculation. The same is true of demand factors. Article 220 is essentially without these necessary factors. But these factors are routinely used by engineers to closely approximate facility loads. Many industrial loads have close to 100% load factor. Important loads like this can't be served by an underground service WHOSE AMPACITY CANNOT BE CALCULATED. The elimination of spacing, thermal resistivity, enclosure type (direct burial cables carry about 33% more current than those in duct banks), and backfill medium from underground calculations is similar to designing an air conditioning system without any criteria. There would be simply no way of determining the output rating.

9. The correct solution is for the NEC to be correct in both the load calculations and the underground ampacity ratings - not to be wrong in both and use one to try to compensate for the other. In an attempt to move in this direction, the following steps have been taken:

a.) Proposed that Article 220 permit load calculations per IEEE Std., 241 for commercial and industrial installations. (LOG NO. 2262, CMP-2)

b.) Made nineteen proposals to Article 310 to cover every ampacity objection that has been publicly discussed or brought to CMP-6 attention since the 1987 NEC was adopted. This should remove the objections.

10. In recent balloting on a T.I.A. on this subject, the only non-panel responder with professional experience in wire and cable applications was the Director of Applications Engineering for a major USA cable company. He said, in part, "The Company agrees with the approach taken in the 1987 Code which makes the designer aware of correct cable ratings for multi-circuit installations."

The manufacturers of insulated cables maintain laboratory staffs dedicated to Research & Development. This work has resulted in cable constructions which comply with industry and code standards providing wire and cable product designs which are safe and of high quality. Proper product application cannot be compromised due to lack of understanding of cable rating techniques."

When the 1987 Code was issued, CMP-6 published what they thought was an adequate number of ampacity tables with the intention of publishing more if the situation required. As it turns out, a few more high ampacity tables seem to be required, but the original judgment was not too bad.

Most of the questions have involved application of the tables and most of the comments have been to the effect that the user does not want to make underground ampacity calculations. The attached proposals answer the questions and eliminate the need for making any ampacity calculations for all underground duct bank applications for which requests were made from the field.

These additional proposal are as follow:

Proposal Number	Involved Section of the NEC	Content of Proposal and Impact on Ampacities
6-71	310-16, and new Figure 310-5	Proven curves permit determinations of ampacity values for any

6-169	New Figure 310-2	Provides nominal ampacities for 2000, 2500, 3000 ampere duct banks where the number of conductors per phase is required or desired to be limited.
6-171	New Figure 310-3	Provides configuration for nominal 4000 ampere duct bank with minimum number of conductors per phase.
6-172	New Figure 310-4	Provides configuration for high ampacity duct banks using nine ducts and three single conductors per duct up to 500 MCM.
6-17	New Figure 310-6	Provides ampacities for nominal 2000, 2500, and 3000 ampere duct banks using a copper conductor size of 500 MCM.
6-155	Additions to Table 310-30	Small USE wire sizes added for extended USE coverage underground.
6-164	Modification to Existing Figure 310-1	Eliminates maximum value of Rho = 90 to permit full utilization of new Figure 310-5.
6-130	Additions to Existing Tables 310-25, 26 & 27	Additions permit the use of any reasonable value of Rho and Load Factor to determine ampacities using Figure 310-5.
6-61	New 310-15(d) and 310-15(e)	These sections provide the definition of load factor and thermal resistivity to facilitate use of the ampacity tables.
6-62	New 310-15(f)	Alternate proposals are submitted to positively cover the ampacity of a conduit circuit inside a concrete building wall, floor, or ceiling.
6-110	New 8(c) in Notes to Tables 310-18 through 310-31	Provides no derating for circuits no longer than 10 feet as they exit underground raceways.
6-143	New Note 4 added to Notes to Tables 310-25, 26, 27	Permits the use of Figure 310-5 to obtain ampacities from these Tables as Rho and Load Factor are varied.
6-168	Modification of Notes to Figure 310-1	Allows underground circuits to change depth to avoid underground obstacles without changing ampacity ratings.
6-53	New fine print notes to Article 310-15(b)	Indicates that the formula shown in this Article is not for stand-alone use but must be used in conjunction with other Neher-McGrath formulae and criteria. References other IEEE publications for additional ampacity tables. Provides basic values of Rho for most common applications.

6-64	New Article 310-15(g)	Provides definition of free air.
6-65	New Article 310-15(h)	Provides ampacities for increased underground burial depth without calculation.
6-122	Revised Title to Table 310-22	Recognizes use of single phase UF and USE.
6-156	Revised Title to Table 310-30	Recognizes use of single phase circuit.
6-159	Revised Title to Table 310-31	Recognizes use of UF and USE cables in this application.

An alternate proposal, Proposal No. 1 is also attached and recommended. This would permit us to retain the underground ampacity tables (and make additions and modifications per the 1990 proposals) while permitting the use of 310-16 underground if one so desired. We agreed to move the 600 volt underground tables either back to Chapter 9 or else renumber and place adjacent to the high voltage ampacity tables. Hopefully, this will still carry the day and provide a true parallel path where everybody gets what is needed to operate in his particular area.

The ampacity tables (and four new tables for 2000-4000 ampere services) are still needed because, contrary to popular opinion, many industrial and commercial users of the tables cannot readily make the Neher-McGrath calculations. The latest proposals make it unnecessary to calculate any underground ampacities and enable you to change the Rho and load factor on any underground duct ampacity table without making calculations. This provides the necessary help for all Code users.

The alternate Proposal recognizes that the housing industry may have single phase underground applications as well as those where conductor loading is significantly reduced from ampacities calculated at continuous load with 100% load factor. This situation is not true for most industrial applications, airports, hospitals, etc., etc. Therefore an alternative proposal, such as the following, is in order.

PROPOSAL NO. 1

Change Section 310-15 as follows:

310-15. Ampacity. The term electrical duct(s) . . . (as is).

(a) Applications by Tables. Ampacities for conductors rated . . . (as is).

(b) Alternative Underground Ampacities. Where loads are calculated in strict accordance with the requirements of Article 220, the ampacities listed in Table 310-16 may be used in lieu of the ampacities listed in Tables 310-25, 26, 27, 28, 29 and 30 and Figures 310-2 through 310-6. In this case, the requirements of Figures 310-1 do not apply. Where a load analysis is performed under engineering supervision, including the effects of diversity, demand factor, load factor, and power factor, then the previous Tables and Figures shall be permitted to be used to determine underground ampacities.

(c) Calculated Ampacities. Ampacities shall be permitted to be calculated under engineering supervision as detailed in the basic ampacity paper, "The Calculation of the Temperature Rise and Load Capability of Cable Systems" by J. H. Neher and M. H. McGrath.

(d) Selection of Ampacity. (Remains as is . . .).
Extend Table 310-16 ambient ratings to -50°C.

(Table 310-16 shown on following page.)

Upgrade existing tables 310-25 thru 30 and Figures 310-1 in accordance with proposals. Add new Figures 310-2, 310-3, 310-4, 310-5, 310-6.

Renumber Tables 310-25, 26, 27, 28, 29, and 30 to 310-40, 41, 42, 43, 44 and 45.

Renumber Notes to Tables 310-25, 26, and 27 to 310-40, 41, and 42.

Change "Notes to Tables 310-69 through 310-84" to "Notes to Tables 310-40 through 310-84."

The proposal provides a parallel path for all underground ampacity users while providing an opportunity to utilize the upgrades and improvements existing in the 1990 Code proposals.

MCCLUNG: There are many who would return to the "good old days." In the case of ampacity tables that would appear to be pre-1984 which also required its own judgement factors based on application of the Code Article 220 Branch Circuit and Feeder Calculations. That is a best guess judgment for use when you do not have details with which to work. It usually resulted in oversizing conductors sufficient that a few tables appeared to cover most needs and even allowed the term "free air" to be used in conjunction with table headings that were for cables in raceway in free air or within a wall, floor, or ceiling which is in free air. On Proposal 6-117 for this 1990 NEC, the Panel 6 ruled that such a statement about free air was technically incorrect.

In applying the Tables 310-77 through 310-84 the Proposal 6-49 recognizes the need for Table 310-1 to cover installation dimensions. Such a need does not disappear just because voltage levels change. Such a need is based on thermal properties of the system not on electrical parameters. Table 310-1 is needed for 0 to 2000 volt services also.

In the Proposal 6-49 an effort is made to concede that where in close proximity the conductor operating temperature of more than nine current carrying conductors may need to be considered when applying Table 310-16 to underground installations.

There have been many complaints about using the tables in the 1987 NEC as well as many suggestions for improving the tables in the 1987 NEC. The complaints appear to be one-sided. The suggestions for making the tables in the 1987 NEC more usable are from many interests.

This proposal would make a mockery of 50 years of technical progress just to serve those who refuse to realize that the Code is for all interest groups.

It would appear that the Code could include a set of tables for use when loads are overestimated and a formula for use when loads are accurately tabulated and calculated plus a separate set of tables for use in most instances when loads are accurately tabulated and calculated (not all interested parties that use the Code have the resources to apply the Neher-McGrath calculation method).

In order to satisfy those interests that want to use accurately tabulated and calculated loads and apply technically correct tables, the suggestions for improvements over the 1987 Code as made by new proposals should be implemented. The specific proposals for the 1987 Code that need to be accepted to achieve this objective are Proposal Numbers 6-17, 6-53, 6-61, 6-62, 6-64, 6-65, 6-71, 6-110, 6-122, 6-130, 6-143, 6-155, 6-156, 6-159, 6-164, 6-168, 6-169, 6-171, and 6-172.

COMMENT ON VOTE:

DURHAM: This proposal was intended to delete Tables 310-25, 310-26, 310-27, 310-28, 310-29, and 310-30, and Notes to Tables 310-25 through 310-27.

STRANIERO: NEMA believes that it was the panels intent to replace underground ampacity tables 310-25, 310-26, 310-27, 310-28, 310-29 and 310-30 with the provision to use Table 310-16 for underground ampacities. The proposed Table 310-16 heading change does not provide for underground ampacities except for not more than three single insulated conductors directly buried.

Proposal 6-49 should be amended to reinstate the second sentence of Note No. 2 to Tables 310-16 through 310-19 of the 1981 NEC which reads as follows:

Application of Tables. For all recognized wiring methods, the allowable ampacities in Tables 310-16 and 310-18 shall be used, unless otherwise provided in this code.

The text for this proposal that was provided with the ballot does not delete tables 310-25 through 310-30 as was discussed and accepted by CMP-6.

COMPARISON OF NEC TABLE 310-16 (FOR COPPER CONDUCTORS) WITH VARIOUS NEHER MCGRATH
AMPACITIES CORRECTED TO THE 30°C AMBIENT USED IN TABLE 310-16

SIZE	NEC TABLE 310-16	3-1/C IN CONDUIT	1-3/C IN CONDUIT	3-1/C IN DUCT	1-3/C IN DUCT	3-1/C DIRECT BURIED	1-3/C DIRECT BURIED	7.5 INCH SPACING - LESS AMPACITY FOR REDUCED SPACING			
								(6-CKTS) 6-3-1/C IN DUCTS	(6-CKTS) 6-3/C IN DUCTS	(2-CKTS) 2-3-1/C DIRECT BURIED	(2-CKTS) 2-3/C DIRECT BURIED
#8	50	53	51	52	49	76	68	40	38	70	64
#6	65	73	67	70	64	97	87	51	49	90	81
#4	85	94	88	90	84	126	113	66	62	116	106
#2	115	127	119	119	109	162	146	84	81	148	136
#1	130	152	137	138	127	184	165	96	92	168	154
#1/0	150	173	162	158	145	209	188	109	105	192	175
#2/0	175	198	185	181	166	237	213	123	118	217	199
#3/0	200	235	211	206	190	270	243	139	134	246	226
#4/0	230	270	248	238	217	307	275	158	152	279	255
250MCM	255	307	273	262	240	335	301	174	166	304	279
350MCM	310	372	337	317	290	403	363	206	198	365	335
500MCM	380	461	412	386	352	485	435	247	236	437	400

AMPACITIES IN AMPS

CONDUCTOR TEMPERATURE = 75°C

RHO = 90 AND 100% LOAD FACTOR USED FOR ALL UNDERGROUNDED APPLICATIONS.

THIS SHOWS THAT AN INSTALLATION WITH
100% LOAD FACTOR WOULD BURN UP WITH
MORE THAN SIX CIRCUITS, THE SITUATION
WOULD BE WORSE.

TABLE 2

COMPARISON OF NEC TABLE 310-16 (FOR COPPER CONDUCTORS) WITH VARIOUS NEHER MCGRATH
AMPACITIES CORRECTED TO THE 30°C AMBIENT USED IN TABLE 310-16

SIZE	NEC TABLE 310-16	3-1/C IN CONDUIT	1-3/C IN CONDUIT	3-1/C IN DUCT	1-3/C IN DUCT	3-1/C DIRECT BURIED	1-3/C DIRECT BURIED	7.5 INCH SPACING - LESS AMPACITY FOR REDUCED SPACING			
								(6-CKTS) 6-3-1/C IN DUCTS	(6-CKTS) 6-3/C IN DUCTS	(2-CKTS) 2-3-1/C DIRECT BURIED	(2-CKTS) 2-3/C DIRECT BURIED
#8	55	60	57	59	55	85	77	44	43	79	72
#6	75	82	76	79	72	109	98	57	56	101	92
#4	95	106	100	103	94	142	127	74	71	131	119
#2	130	142	135	135	123	182	165	95	91	168	154
#1	150	171	154	156	143	208	186	108	104	190	173
#1/0	170	196	182	179	164	236	212	123	118	216	197
#2/0	195	223	208	204	187	268	241	139	133	244	224
#3/0	225	265	239	233	214	305	275	157	151	278	255
#4/0	260	305	279	268	244	345	310	179	171	314	288
250MCM	290	347	309	295	270	378	340	195	187	343	315
350MCM	350	421	381	358	328	454	409	233	224	411	378
500MCM	430	523	466	436	397	548	492	279	268	494	452

AMPACITIES IN AMPS

CONDUCTOR TEMPERATURE = 90°C

RHO = 90 AND 100% LOAD FACTOR USED FOR ALL UNDERGROUNDED APPLICATIONS.

Are we supposed to ignore this?

TABLE 1

6- 14 - (310-15 and Tables 310-16 through 310-19):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

SUBMITTER: Thomas E. Trainor, City of San Diego, CA

RECOMMENDATION: 1) Delete new conductor ampacity Tables 310-22 through 310-31, inclusive, and Figure 310-1.

2) Revise Tables 310-16 through 310-19 to read as they appeared in the 1984 NEC.

3) Revise Sec. 310-15 to read as follows:

310-15 Ampacity

(a) Applications Covered by Tables. Ampacities for conductors rated 0 through 2000 volts shall be as specified in Tables 310-16 through "310-19" and their accompanying notes, "except as permitted in (b) below." The ampacity for types V, AVA, AVB and AVL conductors rated 2001 through 5000 volts shall be the same as for solid dielectric insulated conductors rated 2001 through 35,000 volts shall be as specified in tables 310-69 through 310-84 and their accompanying notes.

(b) Applications not Covered by Tables "or Special Applications." Ampacities not covered by the tables "or ampacities for special applications in commercial and industrial facilities, such as underground or aerial distribution systems", shall be permitted to be calculated, under engineering supervision, by means of the following general formula.

$$I = \sqrt{\frac{TC - (TA + \Delta T_D)}{RDC (1 + YC) RCA}}$$

TC = Conductor temperature in degrees C

TA = Ambient temperature in degrees C

ΔT_D = Dielectric loss temperature rise

RDC = DC resistance of conductor at temperature TC

YC = Component ac resistance resulting from skin effect and proximity effect

RCA = Effective thermal resistance between conductor and surrounding ambient

(FPN): The ampacities provided by this section are based on temperature and do not take voltage drop into consideration.

(FPN): Conductors of circuits as defined in Article 100, sized to prevent a voltage drop exceeding 5 percent, will provide reasonable efficiency of operation.

(c) Selection of Ampacity. When more than one calculated or tabulated ampacity could apply for a given "conductor" length, the lowest value shall be used. "The ampacity of a conductor which connects to electrical equipment shall not exceed the ampacity rating of the terminals of such equipment."

Note: Added material in quotations.

SUBSTANTIATION: There is nothing more critical to a safe electrical installation than the proper selection of conductors adequate for the load to be served. The conductor ampacities in Table 310-16 are the standard for the industry. Conductors have been manufactured to this standard, electrical systems designed to this standard and electrical equipment tested to this standard. Installations based on this standard have an exceptional record of safe operation.

The proposal which led to the adoption of 10 new conductor ampacity tables did not document a single safety issue related to the use of Table 310-16 ampacities. A separate review of this proposal is attached.

It is now clear that the intent in developing new ampacity tables was to permit large industrial type distribution systems to utilize higher ampacities than previously permitted and thereby reduce the cost of such installations. It is certainly acceptable for owners of electrical systems to endeavor to reduce costs where possible. Unfortunately, the method chosen to satisfy these desires has had a disastrous impact on the electrical industry at large. At the most generous estimate, distribution systems utilizing duct systems from vault to vault, underground, represent less than

1% of all underground installations. There are now 6 tables to provide ampacities for such installations. For the other 99% + of underground installations; those that originate above ground, are routed underground for some distance and re-emerge, there are no tables. To compound the problem, Section 310-15(c) requires that the actual ampacity of such circuits be calculated for the underground portion to insure that the lowest applicable ampacity is being used. A simple review of the "unknown" in the general formula makes it clear that the necessary information to use this formula is not readily available.

There are serious safety issues to be raised with these new tables. They have been touted as being "technically correct". This is a misstatement. The Neher-McGrath FORMULA is technically correct. When used properly, it provides an accurate ampacity for a conductor under the specific conditions of the actual installation. Any table developed using Neher-McGrath must identify the exact conditions on which it is based. As an example, Table 310-27 provides ampacities for three single insulated conductors in underground "electrical ducts". The ampacities in this table ARE ONLY ACCURATE under the following conditions listed in the table:

Three single insulated conductors rated 0 through 2000 volts (3 conductors per duct)

In underground electrical ducts.

Based on ambient earth temperature of 20°C (68°F)

Electrical duct arrangement per figure 310-1

100% load factor

Thermal resistance (RHO) of 90

Conductor temperature of 75°C (167°F)

If any one of these conditions varies, the table ampacity is no longer accurate. It is clear that these conditions do vary, both within the perimeters of the table conditions and beyond. Consider each of the identified conditions:

Three single insulated conductors.

The table lists a single ampacity for conductor types RHW, THW, XHHW and USE. Each of these conductor types has different thermal characteristics based on insulation type and thickness. The same ampacity CANNOT be accurate for each of these different conductors.

In underground electrical ducts.

Section 310-15 includes all listed conduits as electrical ducts. Table 310-27 lists a single ampacity regardless of the type of "electrical duct" utilized. It is obvious that the ampacity of, for example, 3 #8 THWN conductors in 1/2 rigid conduit will be significantly different than that of these same 3 conductors in 5" electrical duct because of the difference in thermal resistance between the conductor and the surrounding ambient (RCA).

Ambient earth temperature of 20°C.

The accuracy of this table is dependent on an ambient temperature of 20°C or less. It is documented that the ambient temperature of earth exceeds 20°C in many areas of the U.S. during certain seasons. The proper use of the table requires measurement of ambient earth temperatures wherever the table ampacities are to be used.

Electrical duct arrangement per figure 310-1.

Figure 310-1 represents the typical high voltage duct bank system. It is presently used in conjunction with the 300 plus tables available to engineers to determine ampacity for high voltage systems. It does not correlate with typical underground installations of branch circuits and feeders. The table ampacities only apply to installations conforming to this spacing. All other underground installations will require the use of the general formula to determine an accurate ampacity.

100% load factor.

Except on a few engineered, fixed load systems, this factor can and does vary significantly.

Thermal resistance (RHO) of 90.

This value varies from 60 to 120 and can vary substantially along a run of underground conduits. A value over 90 at any point makes the table ampacities invalid.

Installations of type TW wire in underground conduit will require a separate calculation using the general formula.

Tables based on generalized or average conditions are no more accurate than the previous tables. They are, however, much less safe because they identify the maximum acceptable current based on these conditions. A relatively small change in any one of the conditions could result in current levels which could damage the conductors insulation. It is clearly reasonable to state that these tables are not technically correct and are impractical if not impossible to apply to typical installations.

More importantly, they practically beg to be misapplied. Even knowledgeable persons expect to find conductor ampacity tables for typical underground installations in Section 310- Conductors for General Wiring. All mention of underground has been removed from Table 310-16. However, there are now six new tables that indicate they they apply to underground installations. It takes thoughtful analysis to determine that these tables only apply where conductors are below ground. The requirement to use the general formula in Section 310-15(b) for the most typical of underground installations is not only confusing, but unbelievable.

Many Code users will utilize the underground table ampacities for conductors that emerge from the ground and connect to the terminals of electrical equipment. In most cases, the table current will exceed the rating of the terminal creating an unacceptable and dangerous condition.

Literally hundreds of tables would be required to provide accurate and SAFE ampacities for every conceivable condition. Such tables would obviously be design standards and violate the intent of Section 90-1(c).

More importantly, these new tables reduce safety in the interest of conductor efficiency which clearly violates the most basic principals and purpose of the NEC as expressed in Section 90-1.

These tables are a disservice to the electrical industry and the public and will cause the NEC to be discredited and ignored. An I.A.E.I. survey disclosed that 57% of jurisdictions are deleting these tables. Other jurisdictions will allow misapplication because the tables are confusing and unclear. Such facts require the deletion of these tables.

*Survey Details on Fire With IAEI

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation for Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-049.

FRASURE AND SEGALL: As explained in detail on my negative ballot on Proposal No. 6-49, what is proposed would destroy the validity of the existing high voltage underground ampacity tables. The reference to the Neher-McGrath formula should be deleted and a reference to the basic paper substituted to avoid confusion.

The substantiation is grossly in error. The purpose of the underground ampacity tables is to stop the misuse of Table 310-16 underground with the resulting errors. All other objections are covered in 1990 Code proposals.

What is proposed is to ignore internationally recognized underground application criteria and make this legally satisfactory by permitting the use of Table 310-16, for which there is documented proof that it was calculated only for three single conductors in a conduit in free air, as the basis of all underground applications - in ducts, directly buried, with varying spacing, etc. The proposer hopes that the over estimation of load values by the use of Article 220 criteria will compensate for this misapplication.

The comment that the thermal path through a five inch duct is greater than that of a smaller duct is true. That's the reason it's there - to provide a conservative ampacity no matter what duct size, up to and including 5 inch, is used.

The comment that Table 310-27 is dependent on an earth ambient of 20°C or less is obviously erroneous. Ambient compensating factors are listed from 60 to 300 Centigrade.

See additional comments in my negative ballots on Proposals 6-68 and 6-49.

MCCLUNG: The proposal advocates return to ampacities that have been derived by trial and error and that depend on overestimation of load to be served by use of Article 220. Technically correct tables of ampacity are available and with a fraction of the effort like is used to try to substantiate deleting them could have adequate notes included to clearly explain their application. All people interested in the NEC ampacity tables should recognize the validity of using technically correct information.

Log # 2629

6- 50 - (310-15): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Delete the entire paragraph (definition of electrical duct) and replace with the following:

"Ampacity: The ampacity of conductors shall be determined as follows:"

(a), (b), (c) as shown in the 1987 NEC.

SUBSTANTIATION: By changing "raceway" to electrical duct confusion has been created in the industry. Electrical inspectors and contractors have long recognized that conductor channels commonly known as "utility duct" or just "duct" are materials NOT recognized for NEC application. They also know such materials must be installed (and terminated) underground, and cannot enter buildings.

By the same token, they are all familiar with the term raceway, which is well defined in the NEC.

The term duct also introduces a new definition for a word already in use in the NEC in Article 300-22. More confusion.

This term also creates two different terms for the same products, one for above ground use and one for underground. A raceway is a raceway, and should be termed such.

Conduits not recognized in Chapter 3, but LISTED for underground use, are termed raceways by U.L. (EAXX) and "ducts" should not be used. This will help assure that products which are not NEC recognized, are not used improperly.

The heading for 310-1b is "Ampacity" and the proposed new language clarifies that ampacity is to be determined by (a), (b), and (c).

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on 6-165.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Sallaz, Straniero.

EXPLANATION OF VOTE:

SALLAZ: Electrical duct is not a recognized wiring method in the National Electric Code. See 300-3 (A) NEC.

STRANIERO: During the panel deliberations on this proposal the reason given for using the term "Electrical Duct" instead of the term "Raceway" was that the term "Raceway" is too broad and that since the raceways shown in Figure 310-1 and the corresponding ampacity tables are based on round raceways only, the term "Raceway" could not be used.

The substantiation submitted with proposal 6-50 indicates that the term "Electrical Duct" is even more broad in meaning that is the term "Raceway." When consideration is given to how the term "Electrical Duct" will be cropped in the vernacular of the trade to simply "Duct", the term becomes infinitely broad in meaning.

The proposal should be accepted in principle. The first paragraph of Section 310-15 should be deleted; tables 310-25, 310-26, 310-27, tables 310-77 through 310-80, and notes to tables 310-25, through 310-27 should be revised to change all references from "Electrical Duct" to "Raceway" and a note should be added to Figure 310-1 that states the following:

x. The raceways shown in details 1 through 4 shall be raceways that are round in cross section and recognized in Chapter 3 as suitable for use underground; and other raceways, round in cross section, listed for underground use; embedded in earth or concrete.

By stating that the raceway shall be round in cross section, any concerns about the misuse of the ampacity tables and concerns about the confusion the term "Duct" introduces will be eliminated.

COMMENT ON VOTE:

COFFEY: The fifth paragraph of the submitter's substantiation makes reference to conduits not recognized in Chapter 3 but Listed by UL (EAXX). The substantiation is not correct because the designation (EAXX) covers a product category known as Rigid Nonmetallic Conduit, Underground. This conduit is Listed for use in accordance with Article 347 of the National Electrical Code.

Log # 1150

6- 51 - (310-15): Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line as indicated:
... Chapter 3 as (suitable) "identified" for use

SUBSTANTIATION: Same as Proposal 6-20.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-140.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3270

6- 52 - (310-15): Reject

SUBMITTER: Gilbert L. Thompson, Baltimore County Electrical Inspection Division

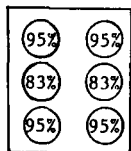
RECOMMENDATION: (1) Leave the wording of the opening paragraph of 310-15 as it is.

(2) Change parts (a) and (b) to the wording found in the 1981 NEC.

(3) After the formula and its explanation of terms, add the following diagram.

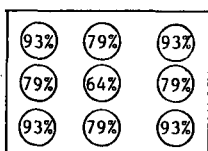
EFFECT of CABLE POSITION in ELECTRICAL DUCTS BANKS

2 by 3 deep



Average 91%

3 by 3 deep



Average 83.5%

(4) After the above diagram, add the 2 Fine Print Notes from the present (b) part of the 1987 NEC.

(5) Part (c) of the 1987 NEC to remain as is.

SUBSTANTIATION: This change will correlate with a proposal to delete tables 310-16 thru 310-84 of the 1987 NEC.

It will also alert installers that the effect of cable positions in Electrical Duct Banks should be taken into consideration.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Substantiation for Proposal 6-49.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

MCCLUNG: I want to reject this proposal because I cannot agree with the efforts to delete Tables 310-16 thru 310-84 of the 1987 NEC. However, the desire to alert installers that the effect of cable positions in electrical duct banks should be taken into consideration is commendable.

Log # 2573

6- 59 - (310-15, FPN-(New); Tables 310-16, 310-25, 310-26, 310-27, 310-28, 310-29, 310-30; Notes to Tables 310-25 through 310-27, Figure 310-17, Tables 310-77 through 310-84):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors

RECOMMENDATION: Table 310-16 change heading to read "Table 310-16 Ampacities of not more than three single insulated conductors in raceways or cable or directly buried and ampacities of cable types, AC, NM, NMC and SE based on ambient air temperatures of 30°C (86°F)."

Delete Tables 310-25, 310-26, 310-27, 310-28, 310-29 and 310-30.

Delete notes to Tables 310-25 through 310-27.

Delete Figure 310-1.

Delete all reference to figure 310-1 from Tables 310-77 through 310-84.

Add fine print note to Section 310-15 to read "(FPN) Due to high operating temperatures, conductor in underground duct banks or direct buried may require special ampacity calculations when operated at or near their rated ampacities".

SUBSTANTIATION: While they may be technically correct these tables are unusable in too many cases to be practical. The ampacities in use prior to 1987 were adequate to provide a safe and reliable installation without the need to apply a complex engineering calculation. The need to apply the formula from Section 310-15 in most practical large capacity circuits is contrary to the purpose of the Code as stated in Section 90-1. The Code in Article 310 has become a design standard. Section 90-1 also states that the provisions of the Code provide for safety but may not be adequate for efficiency.

There were undocumented claims that conductors fail underground, this is not reflected by reports from inspectors nor utilities even though utilities usually install conductors smaller than those required by the Code. If conductors are lost underground safety is not compromised. If conductors are lost underground due to heavy loading the real problem is poor design not poor Code. Designers should consider that the same conditions exist in these cases as do in high ambient temperatures and reduce the ampacity as needed. Let the designers be responsible for their own work. The users of the Code deserve a set of ampacity tables that are reasonable, safe and that work in the real world. Building owners should not be subjected to the inflated cost caused by the ampacities now in use. Cost for conductors alone to install a typical 3000 amp circuit, based on the tables and figure 310-1 has risen from \$6,500.00 with 1984 ampacities to \$11,500.00 with 1987 ampacities. Added to the increased cost of larger conduit and labor the increase is even greater. We must have a return to reasonable Code in Article 310.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-049.

FRASURE AND SEGALL: The comments here are similar to those on Proposals 6-14. The proposal would destroy the validity of the high voltage underground ampacity tables also.

What is proposed is to ignore internationally recognized underground application criteria and make this legally satisfactory by permitting the use of Table 310-16, for which there is documented proof that it was calculated only for three single conductors in a

conduit in free air, as the basis of all underground applications - in ducts, directly buried, with varying spacing, etc. The proposer hopes that the over estimation of load values by the use of Article 220 criteria will compensate for this misapplication.

The proposed fine print note is completely unusable. There is no way of knowing what the true rated ampacity is when using 310-16 underground.

The lack of concern for failures occurring underground is amazing. If an underground service for a major industrial plant or shopping center is lost due to miscalculation, the cost could easily run into the hundreds of thousands of dollars.

I disagree completely with the cost analysis. Unless he truly calculates the load for the installation per some more refined method than article 220, the proposer starts off with three times the ampacity that is needed. The results show that an underground installation designed for actual ampacities will always be less expensive.

Also, NO ONE has successfully installed a 2000 ampere underground service until he has passed 2000/A phase through it on a CONTINUOUS basis. Most of the service entrance designs I have reviewed have grossly overestimated the ampacity required - usually by 100% or more.

How many installers actually go back and check to see that the actual maximum continuous current was on a service entrance after energization? The answer is only those who have important commercial or industrial facilities. The rest only want to hear if there is a failure.

A typical installation with which I am very familiar had a 6000 A service entrance design which the responsible design engineer insisted was required by the NEC. This installation (a high rise building) has been expanded twice since the original design was completed and has never yet exceeded 2850 amperes of service entrance current. NEC load calculations and actual load cycles for the building are available.

The utility took the design data and installed a 3000 KVA transformer. This proved to be more than adequate.

This is why one sees letters in the IAEI magazine where a letter states that "the utility used a much lower rated service entrance than I installed - and it worked." The reason is that the utility correctly calculated the service entrance requirements.

Q.) What does the utility do in their calculations to arrive at a closer estimate of the service entrance requirements?

A.) Primarily, they include a diversity factor which serves to account for the fact that not all load groups in a facility peak at the same time. This reduces the calculated service entrance current by 20 - 70% depending upon the type of facility being served. (Calculated KVA load equals the sum of the individual KVA demands divided by the diversity factor plus an amount for future load growth.)

The Eleventh Edition of the STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS contains diversity factors. Particularly note that the diversity factor for mixed light and power feeders is likely to be in the range of 1.5 to 2. This alone would account for a good part of the discrepancy between NEC and utility load calculations.

Another item that has come to my company's attention is that most NEMA frame motors run at no more than 75% of rated horsepower. The reason for this can be very simply explained. Several mechanical codes recommended that mechanical loads be multiplied by 1.1 as a safety factor. The mechanical engineer does this and builds in a 10% margin. Then the electrical engineer is faced with making the closest NEMA frame motor selection to match this mechanical load. If the load is 7.6 HP, he will not use the service factor, but selects a 10 HP motor; thus building in another 30% or more of safety factor. On the average, the sum of these two factors is about 25%.

A typical load estimating sheet is contained in IEEE Standard 241. This is a recommended format for calculating the electrical load on a facility such as a high rise building, a shopping center, or an industrial plant. Such a format needs to be included in Article 220.

Finally, what is the impact of all this on underground ampacities? Let's assume that the average service entrance only runs at 50% of the calculated ampacity. (This is a good estimate from numbers I have obtained.) This means that the heat in the service conductors is only 25% of the design value (I²R). Since underground services are very sensitive to mutual heating between conductors, it follows that an improperly designed underground system may actually "work" because it only "sees" 25% of the heating for which it was supposedly designed. However, this would be a matter of luck and not good design practice.

It would be quite in order to assume that some improperly designed underground systems have been "saved" by the fact that the required ampacity was miscalculated by a factor of 100% or more. But this is a case of one mistake compensating for another. It is not something one could be sure would happen every time and certainly not something that should be in the NEC.

Today the emphasis throughout the USA is on operating, design, and construction techniques that are lean, mean, SAFE, and reasonably conservative. The NEC can be all of these without embracing guidelines that result in service entrance designs that are 100% larger than they need to be.

If the NEC would evaluate and incorporate some of the above techniques, many of the present large service entrance requirements could be dramatically reduced. The cost savings to the country as a whole would be enormous.

MCCLEUNG: The proposal advocates return to ampacities that have been derived by trail and error and that depend on overestimation of load to be served by use of Article 220. Technically correct tables of ampacity are available and with a fraction of the effort like is used to try to substantiate deleting them could have adequate notes included to clearly explain their application. All people interested in the NEC ampacity tables should recognize the validity of using technically correct information.

Log # 2572, 3403

6- 66 - (310-15, Tables 310-16 through 310-31, Figure 310-1):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative. It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49.

This action will be considered by the Panel as a Public Comment.

SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors (Log #2572)

Robert M. Milatovich, Southwestern Section International Association of Electrical Inspectors (Log #3403)

RECOMMENDATION: 1) Delete new conductor ampacity Tables 310-22 through 310-31, inclusive, and Figure 310-1.

2) Revise Tables 310-16 through 310-19 to read as they appeared in the 1984 NEC.

3) Revise Section 310-15 to read as follows:
310-15 Ampacity.

(a) Applications Covered by Tables. Ampacities for conductors rated 0 through 2000 volts shall be specified in Table 310-16 through "310-19" and their accompanying notes, "except as permitted in (b) below." The ampacity for types V, AVA, AVB and AVL conductors rated 2001 through 5000 volts shall be the same as for solid dielectric insulated conductors rated 2001 through 35,000 volts shall be as specified in tables 310-69 through 310-84 and their accompanying notes.

(b) Applications not Covered by Tables "or Special Applications." Ampacities not covered by the tables "or ampacities for special applications in commercial and industrial facilities, such as underground or aerial distribution systems," shall be permitted to be calculated, under engineering supervision, by means of the following general formula.

$$I = \sqrt{\frac{TC - (TA + \Delta T_D)}{RDC (1 + YC) RCA}}$$

TC = Conductor temperature in degrees C
 TA = Ambient temperatures in degrees C
 ΔT_D = Dielectric loss temperature rise
 RDC = DC resistance of conductor at temperature TC
 YC = Component ac resistance resulting from skin effect and proximity effect

RCA = Effective thermal resistance between conductor and surrounding ambient

(FPN): The ampacities provided by this section are based on temperature and do not take voltage drop into consideration.

(FPN): Conductors of circuits as defined in Article 100, sized to prevent a voltage drop exceeding 5 percent, will provide reasonable efficiency of operation.

(c) Selection of Ampacity. When more than one calculated or tabulated ampacity could apply for a given conductor length, the lowest value shall be used.

SUBSTANTIATION: There is nothing more critical to a safe electrical installation than the proper selection of conductors adequate for the load to be served. The conductor ampacities in Table 310-16 are the standard for the industry. Conductors have been manufactured to this standard, electrical systems designed to this standard and electrical equipment tested to this standard. Installations based on this standard have an exceptional record of safe operation.

The proposal which led to the adoption of 10 new conductor ampacity tables did not document a single safety issue related to the use of Table 310-16 ampacities. A separate review of this proposal is attached.

It is now clear that the intent in developing new ampacity tables was to permit large industrial type distribution systems to utilize higher ampacities than previously permitted and thereby reduce the cost of such installations. It is certainly acceptable for owners of electrical systems to endeavor to reduce costs where possible. Unfortunately, the method chosen to satisfy these desires has had a disastrous impact on the electrical industry at large. At the most generous estimate, distribution systems utilizing duct systems from vault to vault, underground, represent less than 1% of all underground installations. There are now 6 tables to provide ampacities for such installations. For the other 99% + of underground installations; those that originate above ground, are routed underground for some distance and re-emerge, there are no tables. To compound the problem, Section 310-15(c) requires that the actual ampacity of such circuits be calculated for the underground portion to insure that the lowest applicable ampacity is being used. A simple review of the "unknown" in the general formula makes it clear that the necessary information to use this formula is not readily available.

There are serious safety issues to be raised with these new tables. They have been touted as being "technically correct". This is a misstatement. The Neher-McGrath FORMULA is technically correct, when used properly, it provides an accurate ampacity for a conductor under the specific conditions of the actual installation. Any table developed using Neher-McGrath must identify the exact conditions on which it is based. As an example, Table 310-27 provides ampacities for three single insulated conductors in underground "electrical ducts". The ampacities in this table ARE ONLY ACCURATE under the following conditions listed in the table:

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In underground electrical ducts.

Based on ambient earth temperature of 20°C (68°F)

Electrical duct arrangement per figure 310-1

100% load factor

Thermal resistance (RHO) of 90

Conductor temperature of 75°C (167°F)

If any one of these conditions varies, the table ampacity is no longer accurate. It is clear that these conditions do vary, both within the perimeters of the table conditions and beyond. Consider each of the identified conditions:

Three single insulated conductors.

The table lists a single ampacity for conductor types, RHW, THW, XHHW and USE. Each of these conductor types has different thermal characteristics based on insulation type and thickness. The same ampacity CANNOT be accurate for each of these different conductors.

In underground electrical ducts.

Section 310-15 includes all listed conduits as electrical ducts. Table 310-27 lists a single ampacity regardless of the type of "electrical duct" utilized. It is obvious that the ampacity of, for example, 3 #8 THWN conductors in 1/2 rigid conduit will be significantly different than that of these same 3 conductors in 5" electrical duct because of the difference in thermal resistance between the conductor and the surrounding ambient (RCA).

Ambient earth temperature of 20°C.

The accuracy of this table is dependent on an ambient temperature of 20°C or less. It is documented that the ambient temperature of earth exceeds 20°C in many areas of the U.S. during certain seasons. The proper use of the table requires measurement of ambient earth temperatures wherever the table ampacities are to be used.

Electrical duct arrangement per figure 310-1.

Figure 310-1 represents the typical high voltage duct bank system. It is presently used in conjunction with the 300 plus tables available to engineers to determine ampacity for high voltage systems. It does not correlate with typical underground installations of branch circuits and feeders. The table ampacities only apply to installations conforming to this spacing. All other underground installations will require the use of the general formula to determine an accurate ampacity.

100% load factor.

Except on a few engineered, fixed load systems, this factor can and does vary significantly.

Thermal resistance (RHO) of 90.

This value varies from 60 to 120 and can vary substantially along a run of underground conduits. A value over 90 at any point makes the table ampacities invalid.

Conductor temperature of 75°C.

Installations of type TW wire in underground conduit will require a separate calculation using the general formula.

Tables based on generalized or average conditions are no more accurate than the previous tables. They are, however, much less safe because they identify the maximum acceptable current based on these conditions. A relatively small change in any one of the conditions could result in current levels which could damage the conductors' insulations. It is clearly reasonable to state that these tables are not technically correct and are impractical if not impossible to apply to typical installations.

More importantly, they practically beg to be misapplied. Even knowledgeable persons expect to find conductor ampacity tables for typical underground installations in Section 310 - Conductors for General Wiring. All mention of underground has been removed from Table 310-16. However, there are now six new tables that indicate that they apply to underground installations. It takes thoughtful analysis to determine that these tables only apply where conductors are below ground. The requirement to use the general formula in Section 310-15(b) for the most typical of underground installations is not only confusing, but unbelievable.

Many Code users will utilize the underground table ampacities for conductors that emerge from the ground and connect to the terminals of electrical equipment. In most cases, the table current will exceed the rating of the terminal creating an unacceptable and dangerous condition.

Literally hundreds of tables would be required to provide accurate and SAFE ampacities for every conceivable condition. Such tables would obviously be design standards and violate the intent of Section 90-1(c).

More importantly, these new tables reduce safety in the interest of conductor efficiency which clearly violates the most basic principals and purpose of the NEC as expressed in Section 90-1.

These tables are a disservice to the electrical industry and the public and will cause the NEC to be discredited and ignored. An I.A.E.I. survey disclosed that 57% of jurisdictions are deleting these tables. Other jurisdictions will allow misapplication because the tables are confusing and unclear. Such facts require the deletion of these tables.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: CMP 6 Proposal 6-49 provides two methods for determining ampacities. The Panel's proposal provides ampacities for conductors rated 0 through 2000 volts as specified in Tables 310-16 through 310-24 and 310-31, and their accompanying notes.

Ampacities shall be permitted to be calculated under engineering supervision as detailed in the basic ampacity paper, "The Calculation of the Temperature Rise and Load Capability of Cable Systems", by J. H. Neher and M. H. McGrath.

A new fine print note has been added to caution the user to consider operating temperature in underground multiconductor installations.

See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on proposal 6-049.

FRASURE AND SEGALL: My negative comments are identical with those made for 6-14. Also, see my negative ballots on Proposals 6-14 and 6-49.

MCCLUNG: There are many who would return to the "good old days." In the case of ampacity tables that would appear to be pre-1984 which also required its own judgement factors based on application of the Code Article 220 Branch Circuit and Feeder Calculations. That is a best guess judgement for use when you do not have details with which to work. It usually resulted in oversizing conductors sufficient that a few tables appeared to cover most needs and even allowed the term "free air" to be used in conjunction with table headings that were for cables in raceway in free air or within a wall, floor, or ceiling which is in free air. On Proposal 6-117 for this 1990 NEC, the Panel 6 ruled that such a statement about free air was technically incorrect.

In applying the Tables 310-77 through 310-84 the Proposal 6-49 recognizes the need for Table 310-1 to cover installation dimensions. Such a need does not disappear just because voltage levels change. Such a need is based on thermal properties of the system not on electrical parameters. Table 310-1 is needed for 0 to 2000 volt services also.

In the Proposal 6-49 an effort is made to concede that where in close proximity the conductor operating temperature of more than nine current carrying conductors may need to be considered when applying Table 310-16 to underground installations.

There have been many complaints about using the tables in the 1987 NEC as well as many suggestions for improving the tables in the 1987 NEC. The complaints appear to be one-sided. The suggestions for making the tables in the 1987 NEC more usable are from many interests.

This proposal would make a mockery of 50 years of technical progress just to serve those who refuse to realize that the code is for all interest groups.

It would appear that the Code could include a set of tables for use when loads are overestimated and a formula for use when loads are accurately tabulated and calculated plus a separate set of tables for use in most instances when loads are accurately tabulated and calculated (not all interested parties that use the Code have the resources to apply the Neher-McGrath calculation method).

In order to satisfy those interests that want to use accurately tabulated and calculated loads and apply technically correct tables, the suggestions for improvement over the 1987 Code as made by new proposals should be implemented. The specific proposals for the

1987 Code that need to be accepted to achieve this objective are Proposal Numbers 6-17, 6-53, 6-61, 6-62, 6-64, 6-65, 6-71, 6-110, 6-122, 6-130, 6-143, 6-155, 6-156, 6-159, 6-164, 6-168, 6-169, 6-171, and 6-172.

Log # 2802

6- 67 - (310-15 and Tables 310-25 through 310-30 and Figure 310-1):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative. It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49.

This action will be considered by the Panel as a Public Comment.

SUBMITTER: Thomas E. Trainor, City of San Diego, CA

RECOMMENDATION: Delete Tables 310-25 through 310-30, inclusive, and Figure 310-1.

Revise Tables 310-16 through 310-19, inclusive, to read as they appeared in the 1984 Edition of the NEC.

SUBSTANTIATION: Tables 310-25 through 310-30 purport to apply to underground installations. All reference to underground installations has been deleted from Tables 310-16 and 310-18.

However, a review of the installation conditions required for these new underground tables reveals that they only apply where the conductors are in a 20° ambient temperature; that is, actually and physically underground. These tables do not then, apply to underground "circuits," but only to that length of conductor that is underground. Few circuits are installed using one size conductor aboveground and changing to another underground. The installation of conductors from handhole to handhole in an underground distribution system is one example where this might occur. Such installations probably represent less than 1% of the total of underground wiring.

The overwhelming majority of "underground" circuits consist of conductors which originate in distribution panels aboveground, are routed underground for some distance, and are then brought aboveground to connect to equipment. There are NO ampacity tables in the 1987 NEC for these types of installations. There are many tables that may or may not apply to certain portions of these circuits depending upon the conditions of installation. There is also a requirement that ampacity be determined at all points along the circuit to ensure that the lowest ampacity is used. For many of these typical circuits, this requires the use of the formula in Sec. 310-15(b). This is a totally unreasonable and impractical requirement. The information required to use this formula is not available to the typical contractor and is subject to recalculation with any change in load or other condition.

It should be clear that the ampacity of a conductor is limited by two major factors. One is the temperature (caused by current flow and ambient conditions) that the conductor insulation can withstand without damage. The new tables attempt to establish maximum allowable ampacities based on this factor. The other limitation is the temperature (caused by current flow and many other factors) that terminations can withstand without damage. This limitation has been established through the testing of terminations using the ampacities found in Table 310-16. The new tables do not recognize this limitation and provide ampacities that in many cases exceed those permitted at terminations. Because the limitations of the new underground tables are not clearly defined, they can be and are misapplied. The result is improper and unsafe installations.

Providing no tables for the majority of "underground" circuits and six tables for the small minority of underground distribution systems is confusing, poor Code, and a disservice to the electrical construction industry. These tables are being amended or ignored by many jurisdictions because they clearly do not relate to accepted construction practices. This reflects directly on the credibility of the NEC and should be of serious concern to CMP 6.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation for Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comment on proposal 6-049.

FRASURE AND SEGALL: This proposal seems to be an afterthought of the Proposer's Proposal No. 6-14. All the objections discussed are answered in detail in my negative ballots on Proposals Nos. 6-14 and 6-49.

MCCLUNG: Same as Proposal 6-66.

Log # 1515

6- 134 - (310-15, Tables 310-25 through 310-30, Figure 310-1):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: George L. Nejd, A. Epstein and Sons, Inc.

RECOMMENDATION: (Tables 310.25 to 310.30 interface with Article 310.15 and Figure 310-1)

PROPOSAL - Revert back to Table 310.16 of the 1984 NEC.

SUBSTANTIATION: For the past 35 years I have used Tables 310.16 when designing underground service or feeder conductors and have never had a problem that could be contributed to the information listed in these tables. In our company's 65 year history, most of our professional services are in the form of repeat business and through this repeat business we are kept aware of previous problems. I personally have been with the company for over 25 years.

In applying the Neher McGrath formula, values for Delta TD, YC and RCA are not available which makes the process outlined in Article 310-15 impractical, if not impossible.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-049.

FRASURE AND SEGALL: An obvious omission in your proposal is the statement "when designing underground duct banks and large direct burial cable systems." This is where the majority of the problems occur.

If you had referred to the Neher-McGrath paper, your problems on necessary constants would have been answered. Delta TD is zero in 600 volt applications.

Please refer to my negative ballot on Proposal No. 6-68 which documents beyond discussion that Table 310-16 was never intended for underground use or for use with more than one conduit.

Also refer to my negative ballots on the following proposals showing why Figure 310-1 is necessary and other comments pertinent to the subject:

6-14, 6-49, 6-59, 6-126.

MCCLUNG: Same as Proposal 6-66.

Log # 2256

6- 53 - (310-15(b), FPN's-(New)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add fingerprint notes:

(FPN): The intent of the general formula shown above is to refer to the basic ampacity paper, "The Calculation of the Temperature Rise and Load Capability

of Cable Systems" by J. H. Neher and M. H. McGrath, IEEE Paper 57-660. The formula must be utilized in conjunction with this paper. Factors required to use the formula are found in the paper.

(FPN): Ampacities calculated by use of the above formula, for applications not listed in this Code, can usually be found in IEEE Publications Nos. S-135-1 and S-135-2.

(FPN): In the absence of specific test data, the following values of thermal resistivity (Rho) may be used in making calculations in accordance with the formula:

PE = 450 PVC = 650 Rubber and Rubberlike = 500

Concrete = 55 Paper Insulation = 500-550

Damp Soil = 60 Average Soil = 90 Very Dry Soil = 120

(Coastal areas, (90% of USA) (rocky land)

high water
table)

SUBSTANTIATION: Some users are apparently attempting to use this formula without reference to the basic paper. The fingerprint notes should correct the problem. IEEE documents provide ready access to ampacities not covered in the Code. Listed values of Rho are in response to common questions.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Brown, Frasure, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposals 6-017 and 6-049.

FRASURE AND SEGALL: This proposal is critical to the proper specification of underground designs, both in the high voltage and the 0 - 2000 volt areas. It clarifies that the formula now shown in this section is not a "stand-alone" formula, but must be used in conjunction with the Neher-McGrath paper. All necessary application data are in this paper.

Basic values of thermal resistivity are listed that permit proper underground design at all voltage levels. Many requests have been received from the field for this information, and now that we have it, it is not going to be made available to the users unless we change the Panel action.

COMMENT ON VOTE:

MCCLUNG: This proposal will show that the Neher-McGrath formula does not stand alone but needs much supporting data to be properly applied.

Log # 2533

6- 54 - (310-15(b), FPN's-(New)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Add fingerprint notes:

(FPN): The intent of the general formula shown above is to refer to the basic ampacity paper, "The Calculation of the Temperature Rise and Load Capability of Cable Systems" by J. H. Neher and M. H. McGrath, IEEE Paper 57-660. The formula must be utilized in conjunction with this paper. Factors required to use the formula are found in the paper.

(FPN): Ampacities calculated by use of the above formula, for applications not listed in this Code, can usually be found in IEEE Publications Nos. S-135-1 and S-135-2.

(FPN): In the absence of specific test data, the following values of thermal resistivity (Rho) may be used in making calculations in accordance with the formula:

PE = 450 PVC = 650 Rubber and Rubberlike = 500

Concrete = 55 Paper Insulation = 500-550

Damp Soil = 60 Average Soil = 90 Very Dry Soil = 120

(Coastal areas, (90% of USA) (rocky land)

high water
table)

SUBSTANTIATION: Some users are apparently attempting to use this formula without reference to the basic paper. The fingerprint notes should correct the problem. IEEE documents provide ready access to ampacities not covered in the Code. Listed values of Rho are in response to common questions.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 7
NEGATIVE: Brown, Frasure, Segall.
EXPLANATION OF VOTE:
BROWN: Same as Proposal 6-53.
FRASURE AND SEGALL: This is a duplicate proposal to Proposal 6-53. The negative comment is the same.
COMMENT ON VOTE:
MCCLUNG: Same as Proposal 6-53.

Log # 2750

6- 55 - (310-15(b), Exception): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: New text:
Exception: Service conductor installations shall be permitted to follow the guidelines in Section 90-2(c).
SUBSTANTIATION: Presently there is a conflict between these two Code sections. The N.E.C. Style Manual Section A-3.b requires explicit Code language to encourage uniform N.E.C. adoption without alteration. This would imply that Panels No. 1 and No. 6 must reach accord in enforcement requirements. Otherwise I will request by State Board of Building Standards to issue a revision of thier N.E.C. adoption.
PANEL ACTION: Reject.
PANEL COMMENT: Panel does not agree that a conflict presently exists.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1058

6- 56 - (310-15(c)): Reject
SUBMITTER: Truman C. Surbrook, Michigan State University
RECOMMENDATION: Add the words "or feeder" after circuit and before length.
Add the following material to the end of the sentence:
"unless there is a change in conductors at the point where conditions change, such as at the point of entry to a structure from outside."
The section would read as follows:
Where more than one calculated or tabulated ampacity could apply for a given circuit or feeder length, the lowest value shall be used, unless there is a change in conductors at the point where conditions change, such as at the point of entry to a structure from outside.
SUBSTANTIATION: This section does not seem to apply to feeders as well as branch circuits, and it should apply to all runs of conductors.
Present wording leads to the interpretation that wire size is not permitted to change as conditions change, such as a splice in a junction box or pull box at the point or entry to a structure from outside, or at a drip loop. If this is true then all overhead runs of wire would have to be of a size based upon the circuit or feeder conductors within a structure which would generally be from Table 310-16. Likewise, underground runs of wire would be based generally upon Table 310-16 instead of the appropriate table for underground wire. If this is true, then Tables 310-23 through 310-30 should be deleted from the Code. At some point, overhead and underground conductor runs will generally be run on or within a structure for at least a short distance, thus bringing the conductor run under the ampacity selection of Table 310-16 or Table 310-22.
PANEL ACTION: Reject.
PANEL COMMENT: The word circuit refers to any circuit, branch, feeder, or service. It should be apparent that different conductor sizes have different ampacities.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2237

6- 57 - (310-15(c)): Reject
SUBMITTER: Joseph Penachio, Revere, MA
RECOMMENDATION: Delete the phrase "the lowest value shall be used" and replace with "the value of the longest length shall be used".
SUBSTANTIATION: As presently written 200 ft of 500 MCM copper conductors directly buried in earth (Table 310-30-626 amps) emerges for 10 ft and the entire run is rated at 380 amps. Relief is needed.
PANEL ACTION: Reject.
PANEL COMMENT: That portion of a circuit with the shortest length could be long enough to be the determining factor.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2999

6- 58 - (310-15(c), Exception-(New)): Accept
Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposals 6-105 and 6-110. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Add an exception as follows:
Exception: Where two different ampacities apply to adjacent portions of a circuit the higher ampacity shall be permitted to be used beyond the point of transition a distance equal to 10 feet (3.05 m) or 10% of the circuit length figured at the higher ampacity, whichever is less.
SUBSTANTIATION: This proposal will permit more productive use of the new ampacity tables by allowing for short transitional lengths without the necessity of splices at the point of transition. Although generally applied to underground to raceway in air transitions, the proposal also recognizes, for example, messenger cable to raceway transitions. The guiding principle is that the part of the circuit in an ambient that transfers heat more readily (and thus permits a higher ampacity) can and will act as a heat sink for the adjacent part of the circuit. The submitter has been told that 15 feet has been widely used in industry; the proposal errs on the conservative side.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1522

6- 60 - (310-15(d)-(New)): Accept in Principle
Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.
SUBMITTER: R. P. O'Riley, Innovative Education, Inc.
RECOMMENDATION: Add a new section (or it could be a Fine Print Note)
310-15(d) Free Air.
(1) Raceways. Raceways in free air, as used in Tables 310-16, 310-18 and 310-22, shall be considered to be any raceway above ground, run exposed or concealed in walls, ceilings or slabs, including basement slabs and basement walls.
(2) Cable Assemblies. Cable Assemblies in free air, as used in Tables 310-16 and 310-31, shall be considered to be any cable assembly installation installed exposed or concealed, where the cable assembly is permitted to be concealed, in walls, attics, underfloor crawl spaces, ceilings, floors and in above ceiling spaces.
SUBSTANTIATION: There is a real need for an explanation of what the Code means by the term "free air". The electrician in the field and many others are at a total loss as to how to apply the 1987 ampacity tables. In many cases the ampacity tables are being ignored. Without some definition of "free air", the ampacity Tables are ambiguous. The 1987 ampacity tables are losing the grass root installers, the people that really make the Code work in the field. They need some relief.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Frasure, McClung, Segall.

EXPLANATION OF VOTE:

FRASURE AND SEGALL: This is an erroneous definition of what is meant in the cable ampacity business by "free air". The true definition is given in Proposal 6-64. This comes from a NEMA report, but a majority on the panel do not want to use it because it prohibits using Table 310-16 for ampacity ratings within miscellaneous types of enclosures where "free air" truly does not exist.

MCCLUNG: An explanation for "free air" may be needed but it should be a technically correct definition and not one made up to fit specific situations. Panel 6 needs to be consistent; an accept in principle here indicates a need for the definition whereas a reject for 6-64 indicates it is a commonly defined term.

Log # 2250

6- 61 - (310-15(d) and (e)-(New)):

Secretary's Note: The Correlating Committee directs that the action on the definition of "Load Factor" be shown as "Reject." See also the CMP 2 action on Proposal 2-229 for a new Section 220-36.

CMP 6 has no jurisdiction over load calculations. The Correlating Committee directs that the portion of the proposal dealing with the load factor definition be referred to CMP 2 for action. This action will be considered by the Panel as a Public Comment.

The Correlating Committee accepts the Panel 6 action in revising the definition of "Thermal Resistivity".

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add Sections 310-15(d) and 310-15(e) as follows:

310-15(d) Load Factor. Load factor, as used in ampacity determinations, is the ratio of the average power to the maximum demand power on a given system. The interval of time of the maximum demand and the period of time over which the average is taken must be definitely specified, e.g., daily load factor, one hour average peak.

310-15(e) Thermal Resistivity. Thermal resistivity, as used in this Code, refers to the heat transfer capability through a substance by conduction. It is the reciprocal of thermal conductivity and is normally expressed in the units $^{\circ}\text{C-cm/watt}$.

SUBSTANTIATION: These terms are used in the Section 310 without definition. The definitions will improve the applicability of the ampacity tables and figures.

PANEL ACTION: Accept in Principle.

Locate the two proposed sections as additional notes to Tables 310-69 through 310-84.

Revise the second paragraph of the proposal by deleting the word "normally" and inserting "designated Rho and".

PANEL COMMENT: To position information with applicable tables.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Brown, Frasure.

EXPLANATION OF VOTE:

BROWN: This proposal should be accepted. The panel action to "Accept in Principal" only does part of the job. See my comments on 6-017 and 6-049.

FRASURE: This proposal should be accepted. Many questions received from the field indicate a lack of knowledge on this subject that will be eliminated by the addition of these definitions.

Log # 2251

6- 62 - (310-15(f)-(New)): Accept in Principle

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add new paragraph as indicated below:

(f) Raceway Embedded in Building Concrete. Raceway embedded in concrete floors, walls, and ceilings shall be permitted to have ampacities rated in accordance with Table 310-16.

SUBSTANTIATION: Technically the ampacity should be rated in accordance with Table 310-27 for 75°C conductors. However, this Table, corrected to a 30°C ambient gives essentially the same ampacity for a single raceway as Table 310-16, and users are more familiar with Table 310-16 in this application.

Table 310-27 is conservative for this application since the total thermal path to ambient air is less than was calculated in the table. In addition, Table 310-27 gives the proper deratings for more than one raceway and Table 310-16 does not since it has no mutual heating derating. However, parallel raceways are seldom run in a wall, so Table 310-16 will normally suffice.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Frasure, Segall.

EXPLANATION OF VOTE:

FRASURE AND SEGALL: This is really the correct rating system for raceway in concrete floors, walls, and ceilings as explained in the substantiation. Use of Table 310-16 might not work where several raceways were in close proximity to each other.

Log # 2252

6- 63 - (310-15(f)-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add new paragraph as indicated below:

(f) Raceway Embedded in Building Concrete. Raceway embedded in concrete floors, walls, and ceilings shall be permitted to have ampacities rated in accordance with Tables 310-26 and 310-27.

SUBSTANTIATION: This is an alternate proposal to the one with the same wording permitting the use of Table 310-16. This proposal is more technically correct in that it considers 3/c cable as well as 3-1/c and allows for circuit derating due to mutual heating. The ratings are conservative since the thermal path to ambient air is less than was used in the table calculations. It is anticipated that no more than three parallel circuits will be installed in a wall, ceiling, or floor.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel has accepted in principle the submitter's alternate Proposal 6-62.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2257

6- 64 - (310-15(g)-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add Section 310-15(g)

310-15(g) Free Air: This term refers to unconfined air surrounding a raceway or cable(s) having sufficient volume and circulating capability so that the air temperature will remain constant for any loading condition, e.g. outside air.

SUBSTANTIATION: Definition is provided for clarification of meaning as used in the ampacity tables.

PANEL ACTION: Reject.

PANEL COMMENT: See second sentence of Scope of Article 100 "It is not intended to include commonly defined general terms nor commonly defined technical terms from related codes and standards."

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Frasure, McClung, Segall.

EXPLANATION OF VOTE:

FRASURE AND SEGALL: This is the correct definition for free air. It can be found in approximately the same words in several cable manuals and other authoritative sources. The Panel apparently will not adopt it because it could prohibit the use of Table 310-16 (which is based on 3-/c in conduit in free air) for ampacities in miscellaneous enclosures.

The idea that Table 310-16 can be used for any ampacity, anywhere, defies scientific logic. It's time CMP-6 faced this fact.

MCCLUNG: It was obvious by the confusion generated in CMP 6 deliberations that the term "free air" is not commonly understood even if it is commonly defined. This definition is recognized by the IEEE as being technically correct.

COMMENT ON VOTE:

BROWN: The panel addressed the "Free Air" issue as it applies to Table 310-16 in the panel action on Proposal 6-49. They simply deleted the term "Free Air" from the title of Table 310-16. However, the term "Free Air" is also used in the titles of Tables 310-17, 310-18, 310-19, 310-22, and 310-31. In my opinion, the panel action and substantiation on Proposal 6-49 does not adequately address the "Free Air" issue in these other tables. I suppose that Section 310-10 covers this subject, but if the panel specifically addresses "Free Air" in 310-16, it should also be specific in the other tables.

Log # 2258

6- 65 - (310-15(h)-(New)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-61. This action will be considered by the Panel as a Public Comment.

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add Section 310-15(h)

310-15(h) Burial Depth of Underground Circuits. For applications where burial depths must be deeper than shown in the underground ampacity Tables, the following ampacity derating factor shall be permitted to be used:

6% per increased foot of depth for all values of Rho
No rating change is required where the burial depth is decreased.

SUBSTANTIATION: These data facilitate the use of Code underground ampacities in Northern areas where installations must be made below the frost line, etc. No calculations will be required.

Figures were obtained from multiple computer runs on typical installations.

PANEL ACTION: Accept in Principle.

Locate the proposed section as "Note 4" to Tables 310-69 through 310-84.

PANEL COMMENT: To locate the information with the applicable tables.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Brown, Frasure.

EXPLANATION OF VOTE:

BROWN: See my comment on proposal 6-061.

FRASURE: This proposal needs to be more prominently displayed. It should be in Section 310-15 rather than hidden in the rear of the high voltage tables.

Log # 2242

6- 71 - (310-16-(New); Figure 310-5-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: New text:

310-16 Duct Bank Ampacity Modifications.

Figure 310-5 may be used for interpolation or extrapolation for values of Rho and load factor for cables installed in ducts. The upper family of curves shows the variation in ampacity and Rho at unity load factor in terms of I_1 , the ampacity for Rho = 60 and 50% load factor. Each curve is designated for a particular ratio I_2/I_1 where I_2 is the ampacity at Rho = 120 and 100% load factor.

The lower family of curves shows the relationship between Rho and load factor which will give substantially the same ampacity as the indicated value of Rho at 100% load factor.

As an example, suppose it is desired to find the ampacity of a 500 MCM copper cable circuit for six ducts as shown in Table 310-25. At Rho = 60, LF = 50, $I_1 = 583$; for Rho = 120 and LF = 100, $I_2 = 400$.

The ratio $I_2/I_1 = .686$. Entering the curve at Rho = 90 and moving up to 100% load factor, we find the equivalent Rho = 90, and moving up to Ratio = .686, we find $F = .74$. The desired ampacity = $.74 \times 583 = 431$ which agrees with the Table for Rho = 90, LF = 100.

Similarly, for the same circuit, find the ampacity at Rho = 80 and LF = 75. Using Figure 310-5, we find the equivalent Rho = 43, $F = .855$, and the desired ampacity = $.855 \times 583 = 498$ amperes.

(Figure 310-5 shown on following page.)

Values for using this Figures are found in the duct bank ampacity Tables of this Code.

Where the load factor is less than 100% and can be verified by measurement or calculation, the ampacity of duct bank installations is permitted to be modified as shown. Different values of Rho can be accommodated in the same manner.

SUBSTANTIATION: Revised format for Tables 310-25, 310-26 and 310-27 are submitted separately with additional ampacities indicated to permit use of Figure 310-5. New tables being submitted have the necessary values built in.

Several requests have been received for something in the Code that will permit the use of different values of Rho and load factor without having to make extensive calculations. This chart is extremely accurate and serves to satisfy this request.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-169.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on proposals 6-017 and 6-049.

FRASURE AND SEGALL: This is a key addition to the underground ampacity tables and definitely needs to be in the NEC. The Table permits anyone to vary the value of Rho from 60 to 120 and load factor from 50% to 100% without having to make ampacity calculations.

The Figure is extracted from an ICEA document and its accuracy has been proven thousands of times.

All duct bank tables in the NEC, existing or proposed, now have 1990 NEC proposals containing modifications that will permit the use of this Figure with any underground duct bank table in the NEC.

MCCLUNG: This table is essential to allow the user to vary the value of Rho from 60 to 120 and the load factor from 50% to 100% without having to make calculations.

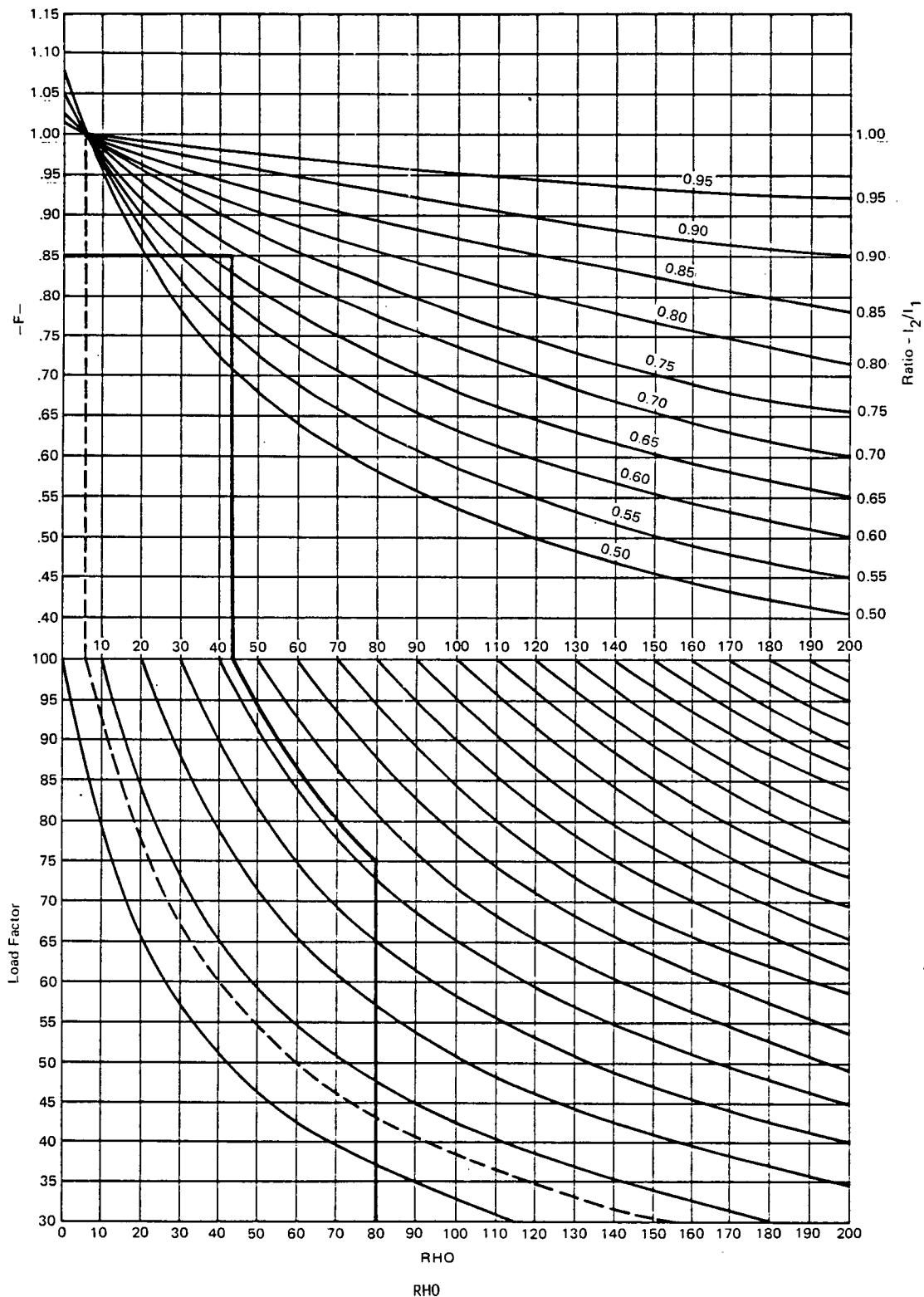


Figure 310-5. Interpolation chart for cables in a
duct bank I_1 = ampacity for Rho-60, 50 LF;
 I_2 = ampacity for Rho-120, 100 LF;
Desired ampacity = $F \times I_1$

6- 68 - (Table 310-16): Reject

SUBMITTER: Truman C. Surbrook, Michigan State UniversityRECOMMENDATION: Add "or within a Wall, Floor or Ceiling which is in Free Air" after Air and before and in the heading to Table 310-16 to read as follows:

Table 310-16. Ampacities of Not More than Three Single Insulated Conductors, Rated 0 through 2000 Volts, in Raceway in Free Air or within a Wall, Floor or Ceiling which is in Free Air and Ampacities of Cable Types AC, NM, NMC and SE.

SUBSTANTIATION: There is no ampacity table which applies to raceway installed within a wall, ceiling or floor of a structure. The phrase "in free air" is used in other Ampacity tables such as for overhead wires and takes on a literal meaning of within free air.PANEL ACTION: Reject.PANEL COMMENT: See Panel Action and Substantiation for Proposal 6-49.

In the Panel's opinion, Section 310-10 adequately covers the subject.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 7

NEGATIVE: Frasure, McClung, Segall.

EXPLANATION OF VOTE:FRASURE AND SEGALL: The professor is correct and his recommendation should be accepted.

Table 310-16 was intended only for 3-1/c in a conduit in free air and the title should so state.

The final report of the NEMA Subcommittee on Determination of Maximum Permissible Current Carrying Capacity of Code Insulated Wires and Cables for Building Purposes, Part IV, dated June 27, 1938 is the document from which Table 310-16 was extracted. This can be verified for every single ampacity.

In the document, the method of calculation is shown - a calculation for one conduit only WITH NO MUTUAL HEATING FACTOR. The tabulation of results matches identically with Table 310-16 and states that the ampacities are for conductors installed in only ONE conduit.

This shows that the proposed use of this Table by CMP-6 Proposal 6-49 is preposterous. Sheets 7 and 14 of the NEMA document are attached to verify the foregoing statements.

Note: Supporting Material Available for Review at NFPA Headquarters.

MCCLUNG: An explanation for "free air" may be needed but it should be a technically correct definition and not one made up to fit specific situations. Panel 6 needs to be consistent; an accept in principal here indicates a need for the definition whereas a reject for 6-64 indicates it is a commonly defined term.

It was obvious by the confusion generated in CMP 6 deliberations that the term "free air" is not commonly understood even if it is commonly defined. This definition is recognized by the IEEE as being technically correct.

6- 69 - (Table 310-16): Accept in Principle

SUBMITTER: Truman C. Surbrook, Michigan State UniversityRECOMMENDATION: Add type UF cable to the title of the table following NMC and before and to read as follows:

Table 310-16. Ampacities of Not More than Three Single Insulated Conductors, Rated 0 through 2000 volts, in Raceway in Free Air and Ampacities of Cable Types AC, NM, NMC, UF and SE.

SUBSTANTIATION: This table also applies to the installation of type UF cable for interior wiring, but it needs to be so stated in the heading to the table to avoid confusion.PANEL ACTION: Accept in Principle.

Add "Type UF Cable" following SE in the heading of Table 310-16.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Frasure and Segall.

EXPLANATION OF VOTE:FRASURE AND SEGALL: Same comment as my ballot on Proposal 6-68.

6- 70 - (Tables 310-16, 310-17, 310-22 and 310-23): Accept

SUBMITTER: CMP 6RECOMMENDATION: Delete asterisk and asterisk note wherever it appears from Tables 310-16, 310-17, 310-22, and 310-23.SUBSTANTIATION: Note reportedly has caused confusion in the field and insulation temperature ratings are adequately covered in table headings and Table 310-13.PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 72 - (Table 310-16): Accept

SUBMITTER: James M. Daly, The Okonite CompanyRECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.SUBSTANTIATION: Same as Proposal 6-39.PANEL ACTION: Accept.VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 73 - (Table 310-16): Reject

SUBMITTER: Ron Wampler, Batavia, OHRECOMMENDATION: Add to the end of the Table heading: "... and Ampacities for Underground Installations of 60 amperes or Less."SUBSTANTIATION: The present underground installation ampacity tables are not practical nor necessary for circuits of 60 amperes or less. Figure 310-1 is not enforceable for smaller feeder and branch circuit installations at sites such as gasoline service stations. The advantages of Table 310-16 should also apply to these smaller underground installations with low demand factors.PANEL ACTION: Reject.PANEL COMMENT: The ampacities of Table 310-16 now apply to 0 to 2000 volt installations of underground conductors.

Figure 310-1 no longer applies to Table 310-16.

See Panel Action and Substantiation on Proposal 6-49 and Panel Action and Panel Comment on Proposal 6-163.

VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 74 - (Table 310-16): Reject

SUBMITTER: Donald W. Zipse, West Chester, PARECOMMENDATION: Place a picture, similar to pictures contained on the attached sheet adjacent to, either on the right or left side of the description of the application for Table 310-16.

(Table 310-16 shown on following page.)

SUBSTANTIATION: To make the selection of the correct table easier, a picture showing what the title describes should be included either on the right or left of the verbiage.

It is said that a picture is worth 1000's words; in this case at least 24.

The title for each table contains at least 5 different items. A mistake on just one item would have a person using the wrong table.

PANEL ACTION: Reject.PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.VOTE ON PANEL ACTION:







AFFIRMATIVE: 9

NEGATIVE: McClung.

EXPLANATION OF VOTE:

MCCLUNG: I am basically against resorting to instructions in the Code on how to use the Code, but the numerous complaints against the technically correct tables indicate that such elementary instructions are necessary if we are to gain acceptance of the proper tables.

AMPACITY TABLES SELECTION







	< 600 Volts		> 2000 Volts	
	60°-90°C	110°-120°C	Cu	Al
 3 - 1/C in RACEWAY AC NM NMC SE	310-16*	310-18*	310-73	310-74
 1/C in AIR	310-17	310-19	310-69	310-70
 1 - 3/C in AIR TRAY TC MC MI SNM	310-31		310-71	310-72
 1 - 3/C Cable in RACEWAY in AIR	310-22		310-75	310-76
 2 or 3 1/C on MESSENGER	310-23		NONE	NONE
 BARE or COVERED Conductor	310-24		310-24	310-24

FMC CORPORATION
D W ZIPSE
OCT. 87

Log # 1932

6- 75 - (Table 310-16): Reject
SUBMITTER: Allen Knickrehm, Los Angeles Chapter NECA Code Committee
RECOMMENDATION: Delete ampacities for 60°C insulated wires number 6 and larger.
SUBSTANTIATION: Manufacturers have stopped marketing these 60°C wires. The excuse that will be made for special order is not a technical reason for not accepting this proposal.
PANEL ACTION: Reject.
PANEL COMMENT: The 60°C ampacity tables are still necessary for cable assemblies used in other articles of this Code.
VOTE ON PANEL ACTION: Unanimously Affirmative.

AMPACITY TABLES SELECTION

	< 600 Volts		> 2000 Volts	
			Cu	Al
 1/C in NON-MAGNETIC Duct UNDERGROUND	Details 2, 3, 4	310-25	3, 6, or 9 Electrical Ducts	NONE
 3/C Cable per Duct	Details 1, 2, 3	310-26	1, 3, or 6 Electrical Ducts	310-79 310-80
 3 - 1/C per Duct	Details 1, 2, 3	310-27*	1, 3, or 6 Electrical Ducts	310-77 310-78
 2/C or 3/C Direct Buried	Details 5, 6	310-28	1 or 2 Circuits	310-83 310-84 (3/C Cable ONLY)
 3 - 1/C Triplex Direct Buried	Details 7, 8	310-29	1 or 2 Circuits	NONE
 3 - 1/C Direct Buried FLAT	Details 9, 10	310-30	1 or 2 Circuits	310-81 310-82

*See AMPACITY ADJUSTMENT FACTORS (Note B)

Log # 1771

6- 76 - (Tables 310-16 through 310-31): Reject
SUBMITTER: Clarence L. Coleman, St. Louis Chapter, NECA
RECOMMENDATION: Revert back to the conductor ampacity tables indicated in the 1984 National Electric Code less those tables shown as being "effective January 1, 1987."
SUBSTANTIATION: Existing tables place an unnecessary liability burden upon the user, designer, installer and the authority enforcing the Code. Requirements are complicated and difficult to achieve compliance. This proposal is not intended to question the laboratory accuracy of the present tables. The proposal only points out how impractical their use and return to previous tried and proven tables.
PANEL ACTION: Reject.
PANEL COMMENT: Substantiation does not indicate specific reasons why submitter believes that the tables are an unnecessary liability. See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2200
6- 77 - (Tables 310-16, -17, -18, -19, -22, -23, -25, -26, -27, -28, -29, -30, -31): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Robert H. Keis, First State Inspection Agency Inc.

RECOMMENDATION: Insert a double vertical line between the copper and aluminum ampacity columns and correction factor tables. Example enclosed.

Table 310-16. Ampacities of Not More Than Three Single Insulated Conductors, Rated 0 through 2000 Volts, in Raceway in Free Air and Ampacities of Cable Types AC, NM, NMC and SE

Based on Ambient Air Temperature of 30°C (86°F).

Size	Temperature Rating of Conductor. See Table 310-13.								Size
	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	
AWG	TYPES 1TW, 1UF	TYPES 1FEW, 1RH, 1RHW, 1THW, 1XHHW, 1USE, 1ZW	TYPE V	TYPES TA, TBS, SA, AVB, SIS, 1FEF, 1FEPB, 1RHH, 1THHN, 1XHHW	TYPES 1TW, 1UF	TYPES 1RH, 1RHW, 1THW, 1XHHW, 1USE	TYPE V	TYPES TA, TBS, SA, AVB, SIS, 1RHH, 1THHN, 1XHHW*	AWG
MCM									MCM
18	....	....	....	14	....	....	....	....	18
16	....	....	....	18	....	....	....	....	16
14	20†	20†	25	25†	20†	20†	25	25†	14
12	25†	25†	30	30†	25	30†	30	35†	12
10	30	35†	40	40†	30	30†	40	45†	10
8	40	50	55	55	40	40	50	55	8
6	55	65	70	75	55	65	75	80	6
4	70	85	95	95	70	85	95	100	4
3	85	100	110	110	85	100	110	115	3
2	95	115	125	130	95	115	125	130	2
1	110	130	145	150	110	130	145	150	1
1/0	125	150	165	170	125	150	165	170	1/0
2/0	145	175	190	195	145	175	190	195	2/0
3/0	165	200	215	225	165	200	215	225	3/0
4/0	195	230	250	260	195	230	250	260	4/0
250	215	255	275	290	215	255	275	290	250
300	240	285	310	320	240	285	310	320	300
350	260	310	340	350	260	310	340	350	350
400	280	335	365	380	280	335	365	380	400
500	320	380	415	430	320	380	415	430	500
600	355	420	460	475	355	420	460	475	600
700	385	460	500	520	385	460	500	520	700
750	400	475	515	535	400	475	515	535	750
800	410	490	535	555	410	490	535	555	800
900	435	520	565	585	435	520	565	585	900
1000	455	545	590	615	455	545	590	615	1000
1250	495	590	640	665	495	590	640	665	1250
1500	520	625	680	705	520	625	680	705	1500
1750	545	650	705	735	545	650	705	735	1750
2000	560	665	725	750	560	665	725	750	2000
AMPCITY CORRECTION FACTORS									
Ambient Temp. °C	For ambient temperatures other than 30°C (86°F), multiply the ampacities shown above by the appropriate factor shown below.								Ambient Temp. °F
21-25	1.08	1.05	1.04	1.04	1.08	1.05	1.04	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	79-86
31-35	.91	.94	.95	.96	.91	.94	.95	.96	88-95
36-40	.82	.88	.90	.91	.82	.88	.90	.91	97-104
41-45	.71	.82	.85	.87	.71	.82	.85	.87	106-113
46-50	.58	.75	.80	.82	.58	.75	.80	.82	115-122
51-55	.41	.67	.74	.76	.41	.67	.74	.76	124-131
56-60	....	.58	.67	.71	....	.58	.67	.71	133-140
61-70	....	.33	.52	.58	....	.33	.52	.58	142-158
71-80	....	....	.30	.41	....	....	.30	.41	160-176

*Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG, and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum after any correction factors for ambient temperature and number of conductors have been applied.

*For dry and damp locations only. See 75°C column for wet locations.

SUBSTANTIATION: These Tables have always been difficult to read anyway. The inexperienced user has a problem separating the columns, and a double line to separate the conductor material would make these Tables much more clear and understandable.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3271
6- 78 - (Tables 310-16 through 310-84 and the Notes): Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Gilbert L. Thompson, Baltimore County Electrical Inspection Division

RECOMMENDATION: Replace tables 310-16 thru 310-84 and the notes to these tables WITH tables 310-16 thru 310-84 and the notes to those tables found in the 1981 NEC.

SUBSTANTIATION: To eliminate a set of tables and notes that have caused confusion and contention to the electrical industry.

From field experience, from attending electrical seminars, and from reading notes and hearing discussions from noted experts discussing the tables found in the 1987 NEC, it can surely be said that they are not understood by engineers, installers, or inspectors. This means that they are not being properly applied and so are not being uniformly enforced - in fact, in our area, they are being held in abeyance until someone comes up with a proper educational program so that they can be properly applied.

The comments received to change the 1984 NEC indicated that there were failures in the conductors themselves that were being installed as direct buried circuits and also to ones that were pulled in ducts and raceways underground. Those comments were never substantiated and in our area we have found that there is not a problem in the conductor, but when one occurs, it is almost always in the termination point and not in the wire. With manufacturers making the better grade heat-resistant insulation, isn't the better thing to do is to eliminate the present tables, re-instate the old ones, limit the current draw on the termination points and draw attention to the heating effect of installing raceways or ducts in banks.

See proposal to change 310-15.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: See Panel Action and Substantiation for Proposal 6-49.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 6
NEGATIVE: Brown, Frasure, McClung, Segall.
EXPLANATION OF VOTE:
BROWN: See my comments on Proposal 6-049.
FRASURE AND SEGALL: See my comments on negative ballots to Proposals 6-14, 6-59, 6-68, and 6-49. They cover the same subject matter.
MCCLUNG: Same as Proposal 6-66.

See proposal to change 310-15.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation for Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-049.

FRASURE AND SEGALL: See my comments on negative ballots to Proposals 6-14, 6-59, 6-68, and 6-49. They cover the same subject matter.

MCCLUNG: Same as Proposal 6-66.

Log # 2574
6- 79 - (Tables 310-16 through 310-31: Obelisk Footnotes): Reject

SUBMITTER: M. E. Avigliano, IAEI Code Clearing Committee, International Association of Electrical Inspectors

RECOMMENDATION: Unless otherwise permitted elsewhere in this Code, the ampacity and the overcurrent protection for conductor types . . . (rest to remain unchanged).

SUBSTANTIATION: The revision of the footnote which was made for the 1987 N.E.C. did not completely resolve the problem of how the footnote affects motor circuits.

Section 430-22(a) requires motor branch circuit conductors to have an "ampacity" of 125% of the motor F.L.C. Therefore, a 16 amp motor circuit requires 20 ampere rated conductors. For 3 conductors in a conduit, Table 310-16 lists the ampacity of 60°C copper as 20 amperes (we won't even get into the 75° and 90°C ratings). There is nothing in the Table, the footnote, or elsewhere that limits the "final" ampacity to 15 amperes. The footnotes does not limit the ampacity. It only limits the fuse or circuit breaker size. But, the change in the '87 Code change removes that limit with respect to motor circuits.

If it is the intent of the panel to allow #14 AWG to be used for 20 ampere motor circuits, then make no change. However, if that is not the intent, then a change is needed. This proposed change will still allow the higher values found in the body of the table to be used as a starting point for any type of derating which may be required. But, it will restrict the final use to the values of the footnote.

PANEL ACTION: Reject.

PANEL COMMENT: It was not the Panel's intent to limit the ampacity rating of those conductor sizes in the obelisk note.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1238

6- 80 - (Tables 310-16 through 310-31, Obelisk

Footnotes): Reject.

SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I.

RECOMMENDATION: Revise as follows:

Unless otherwise permitted elsewhere in this Code, the ampacity and the overcurrent protection for conductor types . . . (rest to remain unchanged).

SUBSTANTIATION: The revision of the footnote which was made for the 1987 N.E.C. did not completely resolve the problem of how the footnote affects motor circuits.

Section 430-22(a) requires motor branch circuit conductors to have an "ampacity" of 125% of the motor F.L.C. Therefore, a 16 amp motor circuit requires 20 ampere rated conductors. For 3 conductors in a conduit, Table 310-16 lists the ampacity of 60°C copper as 20 amperes (we won't even get into the 75° and 90°C ratings). There is nothing in the Table, the footnote, or elsewhere that limits the "final" ampacity to 15 amperes. The footnote does not limit the ampacity. It only limits the fuse or circuit breaker size. But, the change in the '87 Code change removes that limit with respect to motor circuits.

If it is the intent of the panel to allow #14 AWG to be used for 20 ampere motor circuits, then make no change. However, if that is not the intent, then a change is needed. This proposed change will still allow the higher values found in the body of the table to be used as a starting point for any type of derating which may be required. But, it will restrict the final use to the values of the footnote.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-79.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 662

6- 114 - (Table 310-17): Accept

SUBMITTER: Dan Leaf, Westlake Village, CA

RECOMMENDATION: Insert: "UF" with obelisk under copper 60°C column.

SUBSTANTIATION: Single conductor type UF appears to be permitted for open wiring per Sections 225-4 and 320-5(a).

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1993

6- 115 - (Table 310-17): Accept

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2893

6- 116 - (Table 310-17): Reject

SUBMITTER: Donald W. Zipse, West Chester, PA

RECOMMENDATION: Place a picture. Similar to pictures contained on the attached sheet adjacent to, either on the right or left side of the description of the application for Table 310-17.

(Table 310-17 shown on following page.)

SUBSTANTIATION: Same as Proposal 6-74.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: McClung.

EXPLANATION OF VOTE:

MCCLUNG: I am basically against resorting to instructions in the Code on how to use the Code, but the numerous complaints against the technically correct tables indicate that such elementary instructions are necessary if we are to gain acceptance of the proper tables.

COMMENT ON VOTE:

COFFEY: I have voted affirmative on the panel action to reject this proposal but I feel the panel comment should be expanded to read, "See panel action and substantiation on Proposal 6-49."

Log # 1057

6- 117 - (Table 310-18): Reject

SUBMITTER: Truman C. Surbrook, Michigan State University

RECOMMENDATION: Add "or within a Wall, Floor or Ceiling which is in Free Air" after Air and before Based in the heading to Table 310-18 to read as follows:

Table 310-18. Ampacities of Not More than Three Single Insulated Conductors, Rated 0 through 2000 Volts, 110° to 250°C, in Raceway in Free Air or within a Wall, Floor or Ceiling which is in Free Air, Based on Ambient Air Temperature of 40°C (104°F).

SUBSTANTIATION: Same as Proposal 6- (Log #1055).

PANEL ACTION: Reject.

PANEL COMMENT: In the Panel's opinion, Section 310-10 adequately covers the subject.

Proposal assumes that the air within ALL walls, floors, and ceilings is 40°C, which is technically incorrect. See Panel Comment on Proposal 6-64.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: McClung.

EXPLANATION OF VOTE:

MCCLUNG: My comment on this affirmative vote is to validate the confusion that exists over the term "free air." The definition given in Proposal 6-64 should be accepted since it is apparently not commonly understood.

Log # 1994

6- 118 - (Table 310-18): Accept

SUBMITTER: James M. Daly, The Okonite Company







RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.






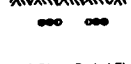
VOTE ON PANEL ACTION: Unanimously Affirmative.

AMPACITY TABLES SELECTION

	< 600 Volts		> 2000 Volts	
	60°-90°C	110°-120°C	Cu	Al
	310-16*	310-18*	310-73	310-74
3 - 1/C in RACEWAY AC NM NMC SE				
	310-17	310-19	310-69	310-70
1/C in AIR				
	310-31		310-71	310-72
1 - 3/C in AIR TRAY TC MC MI SMM				
	310-22		310-75	310-76
3/C Cable in RACEWAY in AIR				
	310-23		NONE	NONE
2 or 3 1/C on MESSENGER				
	310-24		310-24	310-24
BARE or COVERED Conductor				

FMC CORPORATION
D. W. ZIPSE
OCT. 87

AMPACITY TABLES SELECTION

	< 600 Volts		> 2000 Volts	
			Cu	Al
	Details 2, 3, 4	310-25	3, 6, or 9 Electrical Ducts	NONE
1/C in NON-MAGNETIC Duct UNDERGROUND				
	Details 1, 2, 3	310-26	1, 3, or 6 Electrical Ducts	310-79 310-80
3/C Cable per Duct				
	Details 1, 2, 3	310-27*	1, 3, or 6 Electrical Ducts	310-77 310-78
3 - 1/C per Duct				
	Details 5, 6	310-28	1 or 2 Circuits	310-83 310-84 (3/C Cable ONLY)
2/C or 3/C Direct Buried				
	Details 7, 8	310-29	1 or 2 Circuits	NONE NONE
3 - 1/C Triplex Direct Buried				
	Details 9, 10	310-30	1 or 2 Circuits	310-81 310-82
3 - 1/C Direct Buried FLAT				

*See AMPACITY ADJUSTMENT FACTORS (Note 8)

Log # 2894

6- 119 - (Tables 310-18 to 310-84): Reject
SUBMITTER: Donald W. Zipse, West Chester, PA
RECOMMENDATION: Place a picture, similar to pictures contained on the attached sheet adjacent to, either on the right or left side of the description of the application for Tables 310-18 to 84.
SUBSTANTIATION: See attachment to Table 310-16 Proposal 6- (Log #2892).

To make the selection of the correct table easier, a picture showing what the title describes should be included either on the right or left of the verbiage.

It is said that a picture is worth 1000's words; in this case at least 24.

The title for each table contains at least 5 different items. A mistake on just one item would have a person using the wrong table.

In order to reduce paper work, and assuming Table 310-16 proposal was accepted this proposal is intended to cover the balance of the tables. What was done to one table should be added to all tables.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: McClung.

EXPLANATION OF VOTE:

MCCLUNG: Same as Proposal 6-74.

Log # 1995

6- 120 - (Table 310-19): Accept

SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1996

6- 121 - (Table 310-22): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2259

6- 122 - (Table 310-22): Accept
SUBMITTER: J. W. Frasure, Houston, TX
RECOMMENDATION: Change the title to, "Ampacities of Two or Three Insulated Conductors, . . . Overall Covering (Multiconductor Cable) . . ."
 Add + UF in 60°C column.
SUBSTANTIATION: To recognize use of UF cable in these applications.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 357

6- 123 - (Tables 310-22 through 310-31): Reject
SUBMITTER: Bob Middleton, Pocatello, ID
RECOMMENDATION: Deleted Tables 310-22--310-31.
SUBSTANTIATION: These tables are not workable. We used 310-16-310-19 for years, and I know of no problems that were caused.
PANEL ACTION: Reject.
PANEL COMMENT: The substantiation does not indicate specific reasons why the submitter believes the tables are not workable; see Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 763

6- 124 - (Tables 310-22 through 31): Reject
SUBMITTER: Nathan D. Sorensen, Walker Engineering
RECOMMENDATION: Delete Tables 22 through 31.
SUBSTANTIATION: Tables are unusable.
PANEL ACTION: Reject.
PANEL COMMENT: The submitter in his substantiation does not indicate specific reasons why the tables are not usable; see Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1997

6- 125 - (Table 310-23): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3148

6- 126 - (Tables 310-23 to 310-30):
 Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
 It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Daniel Caddigan, Chicago, IL
RECOMMENDATION: Delete Tables 310-23 to 310-30
SUBSTANTIATION: Tables 310-23 through 310-30 create more problems than they solve. Leaving them in the Code creates much potential for abuse. The areas in which each table can be used are so limited as to require proper supervision as specified in 310-15(b) even though the tables are in the Code Book.

Table 310-23 is for two or three single insulated conductors supported on a messenger. Does this mean two or three insulated conductors with the messenger as a third or fourth uninsulated conductor (triplex or quadraplex as specified in 321-1(4))?

Strictly speaking, Quadraplex consisting of three insulated conductors on a messenger consisting of a fourth uninsulated conductor could not be sized from Table 310-23, because it consists of four (4) conductors. In that case, no Table would apply and engineering supervision would be required per 310-15(b). Is this what the Code Panel desired?

Table 310-24 applies with 2 feet per second wind velocity. How is one to measure this wind velocity? I understand that 2 feet per second is approximately 1 1/3 miles per hour of wind speed. In a majority of cases there will always be this wind speed over the conductors. Perhaps, the convection of heat from the conductors alone will create this wind speed. If that is the case, the 2 feet/second velocity is not needed, but by specifying a wind speed, the Code requires the installer, engineer, and inspector to verify that there will always be 2 feet per second of wind speed, perhaps an impossible problem.

Tables 310-25, 310-26, 310-27, 310-28, 310-29 and 310-30 again create more problems for the installer than they solve. If a contractor had to install a 2000 A feeder underground in a raceway from Building A to Building B, it could not be accomplished using Tables. In addition, the installer would have to verify the thermal resistance of the soil to insure that RHO was 90 throughout the entire run. On an underground feeder through an established plant, this may be hard to accomplish.

In summary, Tables 310-23 through 310-30, while appearing to be of great use, are so limited in their use. The supervision requirements of 310-15(b) should be applied to the Tables. There are two ways of responding to this limitation, 1) By adding additional tables to cover more alternatives, or 2) By deleting the Tables which would still allow their use under engineering supervision as presently allowed for any variations for the Tables (which is most cases as describe above) as specified in 310-15(b).

I understand the desire of the Code to include a table for most installations. To some extent, I agree with this trend. If we continue this trend by adding more tables, however, shortly the Code will have many more tables, each with its own peculiar application to select the appropriate table.

Section 90-1(c) states that the Code is not a design specification, the present tables read like a specification for particular circumstances. These tables should be eliminated, leaving the designing for each job to qualified persons as outlined in 310-15(b).

PANEL ACTION: Accept in Principle.

PANEL COMMENT: The substantiation does not indicate specific reasons why the submitter feels that the tables create more problems than they solve. See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: I agree with the Panel comment that the substantiation does not indicate specific reasons why the submitter feels that the tables create more problems than they solve. I don't agree with the Panel action to "Accept in Principle." See my comments on Proposal 6-049. Tables 310-23 and 310-24 are widely used in industrial applications and should not be deleted. If the submitter has questions on the proper application of these tables, he should seek answers to his questions, not delete the tables.

FRASURE: Table 310-23 means exactly what it says - two or three insulated conductors supported on a messenger. The messenger is for support and fault return path only. The cables are attached to the messenger by lashing wire or lashing rods. This is probably the third most widely used method of power distribution used in industrial plants, following only cable tray and conduit in its use. I know of one plant that contains over 200 circuit miles of this type of distribution.

Also, please note from attached Table 10-1 of the ALUMINUM ELECTRICAL CONDUCTOR HANDBOOK that the ampacities listed in Table 310-23 are essentially the same as the ampacities shown for quadruplex aerial installations. Therefore the Table can also be used for duplex, triplex, and quadruplex installations since the ampacities shown will be a little conservative for the duplex and triplex installations. The same relationships hold for copper conductors.

Table 310-24 is a typical linewire table. The parameters shown are extracted from nationally recognized papers by Gorub and Wolf, and by Shurig and Frick, on the subject. They also represent the criteria used by over 35 utilities in rating these conductors. No wind measurement has to be made. The Table merely acknowledges that there is some air flow over the conductors at all times, either by convection or by wind movement. Every industrial plant I have ever worked in or for utilizes this type distribution in varying amounts. The Code, as you know, is for all types of wiring applications up to 35 kV.

Also see my negative comments on Proposals Nos. 6-14, 6-49, 6-59, and 6-68. They cover more on the same subject.

Note: Supporting Material Available for Review at NFPA Headquarters.

MCCLUNG: These tables are necessary for the applications described in the headings. The use of tables where appropriate will eliminate confusion—not add to it.

SEGALL: Table 310-23 means exactly what it says — two or three insulated conductors supported on a messenger. The messenger is for support and fault return path only. The cables are attached to the messenger by lashing wire or lashing rods. This is probably the third most widely used method of power distribution used in industrial plants, following only cable tray and conduit in its use. I know of one plant that contains over 200 circuit miles of this type of distribution.

Table 310-24 is a typical linewire table. The parameters shown are extracted from nationally recognized papers by Gorub and Wolf, and by Shurig and Frick, on the subject. They also represent the criteria used by over 35 utilities in rating these conductors. No wind measurement has to be made. The Table merely acknowledges that there is some air flow over the conductors at all times, either by convection or by wind movement. Every industrial plant I have ever worked in or for utilizes this type distribution in varying amounts. The Code, as you know, is for all types of wiring applications up to 35 kV.

Also see my negative comments on Proposals Nos. 6-14, 6-49, 6-59, and 6-68. They cover more on the same subject.

Log # 1998

6- 127 - (Table 310-24): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in four places in the Table headings.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1999

6- 128 - (Table 310-25): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3296

6- 129 - (Table 310-25):

Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.

It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Marvin J. Lefkowitz, Acme Electric Company, Inc.

RECOMMENDATION: Eliminate Table 310-25, revert to 1984 code standard.

SUBSTANTIATION: This configuration could mislead contractors to pull conductors into metal enclosures wherein the conductors could be spaced far enough apart to cause inductive heating.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-049. The submitter does make a good point in his substantiation. When using this table, care should be taken to insure against inductive heating in metal termination enclosures. But Table 310-25 does not necessarily create this problem and, in my opinion, should not be deleted.

FRASURE AND SEGALL: The proposed problem is guarded against by the use of non-magnetic plates and cable bushings where this could be a problem. On many large installations it is impossible to group all phase conductors, neutrals, and equipment grounding conductors together.

MCCLUNG: The concern is resolved by proper application of nonmagnetic plates (aluminum or glastic plates) and cable bushings.

Log # 2249

6- 130 - (Tables 310-25, 310-26, 310-27): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add ampacities for Rho = 60, LF = 50 and Rho = 120, LF = 100.

(Tables 310-25, 310-26 and 310-27 shown on following pages.)

SUBSTANTIATION: To permit calculation of an infinite number of ampacities achievable by varying Rho and LF using new Figure 310-5.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: This is a key proposal to permit additions to Tables 310-25, 310-26, and 310-27 that will allow Rho to be varied from 60 to 120 and load factor to be varied from 50% to 100% in the use of these Tables without having to make ampacity calculations. It enormously enhances the usefulness of the Tables.

Reference is made to the use of new Figure 310-5 in order to accomplish this.

MCCLUNG: This proposal is needed to make these tables more useful by allowing Rho to be varied from 60 to 120 and load factor to be varied from 50% to 100% without having to perform calculations.

Table 310-25. Ampacities of Single Insulated Conductors, Rated 0 through 2000 Volts, in Nonmagnetic Underground Electrical Ducts (One Conductor per Electrical Duct)

Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement as per Figure 310-1, 100 Percent Load Factor, Thermal Resistance (RHO) of 90, Conductor Temperature 75°C (167°F)

Size							Size
MCM	3 Electrical Ducts (Fig. 310-1 Detail 2)	6 Electrical Ducts (Fig. 310-1 Detail 3)	9 Electrical Ducts (Fig. 310-1 Detail 4)	3 Electrical Ducts (Fig. 310-1 Detail 2)	6 Electrical Ducts (Fig. 310-1 Detail 3)	9 Electrical Ducts (Fig. 310-1 Detail 4)	MCM
	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
250	410 344 327	386 295 275	369 270 252	320 269 256	302 230 214	288 211 197	250
350	503 418 396	472 355 330	446 322 299	393 327 310	369 277 258	350 252 235	350
500	624 511 484	583 431 400	545 387 360	489 401 379	457 337 313	430 305 284	500
750	794 640 603	736 534 494	674 469 434	626 505 475	581 421 389	539 375 347	750
1000	936 745 700	864 617 570	776 533 493	744 593 557	697 491 453	629 432 399	1000
1250	1055 832 781	970 686 632	854 581 536	848 668 627	779 551 508	703 478 441	1250
1500	1160 907 849	1063 744 685	918 619 571	941 736 689	863 604 556	767 517 477	1500
1750	1250 970 907	1142 793 729	976 551 599	1026 796 745	937 651 598	823 550 507	1750
2000	1332 1027 959	1213 836 768	1036 683 628	1103 850 794	1005 693 636	877 581 535	2000

Ampacity in left hand column is for Rho = 60, LF = 50%

Ampacity in right hand column is for Rho = 120, LF = 100%

Ambient Temp. °C	For ambient temperatures other than 20°C (68°F) multiply the ampacities shown above by the appropriate factor shown below.						Ambient Temp. °F
6-10	1.09	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	.90	79-86

Table 310-26. Ampacities of Three Insulated Conductors, Rated 0 through 2000 Volts, Within an Overall Covering (Three Conductor Cable) in Underground Electrical Ducts (One Cable per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement as per Figure 310-1, 100 Percent Load Factor, Thermal Resistance (RHO) of 90, Conductor Temperature 75°C (167°F)

Size							Size
	1 Electrical Duct (Fig. 310-1) Detail 1	3 Electrical Ducts (Fig. 310-1) Detail 2	6 Electrical Ducts (Fig. 310-1) Detail 3	1 Electrical Duct (Fig. 310-1) Detail 1	3 Electrical Ducts (Fig. 310-1) Detail 2	6 Electrical Ducts (Fig. 310-1) Detail 3	
AWG MCM	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	TYPES RHW, THW, THWN, XHHW, USE	AWG MCM
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
14	23†	21†	19†	....	....	....	14
12	29†	26†	24†	....	....	....	12
10	39†	34†	31†	....	....	....	10
8	58 54 53	56 48 46	53 42 39	45 42 41	43 37 36	41 32 30	8
6	77 71 69	74 63 60	70 54 51	60 55 54	57 49 47	54 42 39	6
4	101 93 91	96 81 77	91 69 65	78 72 71	75 63 60	71 54 51	4
2	132 121 118	126 105 100	119 89 83	103 94 92	98 82 78	92 70 65	2
1	154 140 136	146 121 114	137 102 95	120 109 106	114 94 89	107 79 74	1
1/0	177 160 156	168 137 130	157 116 107	138 125 122	131 107 101	122 90 84	1/0
2/0	203 183 178	192 156 147	179 131 121	158 143 139	150 122 115	140 102 95	2/0
3/0	233 210 204	221 178 168	205 148 137	182 164 159	172 139 131	160 116 107	3/0
4/0	268 240 232	253 202 190	234 168 155	209 187 182	198 158 149	183 131 121	4/0
250	297 265 256	280 222 209	258 184 169	233 207 201	219 174 163	202 144 132	250
350	363 321 310	340 267 250	312 219 202	285 252 244	267 209 196	245 172 158	350
500	444 389 375	414 320 299	377 261 240	352 308 297	328 254 237	299 207 190	500
750	552 478 459	511 388 362	462 314 288	446 386 372	413 314 293	374 254 233	750
1000	628 539 518	579 435 405	522 351 321	521 447 430	480 361 336	432 291 266	1000

Ampacity in left hand column is for Rho = 60, LF = 60%

Ampacity in right hand column is for Rho = 120, LF = 100%

Ambient Temp. °C	For ambient temperatures other than 20°C (68°F) multiply the ampacities shown above by the appropriate factor shown below.						Ambient Temp. °F
6-10	1.09	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	.90	79-86

†Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG and 30 amperes for 10 AWG copper, or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum.

Table 310-27. Ampacities of Three Single Insulated Conductors, Rated 0 through 2000 Volts, in Underground Electrical Ducts (Three Conductors per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement per Figure 310-1, 100 Percent Load Factor, Thermal Resistance (RHO) of 90, Conductor Temperature 75°C (167°F)

Size							Size
	1 Electrical Duct (Fig. 310-1) Detail 1	3 Electrical Ducts (Fig. 310-1) Detail 2	6 Electrical Ducts (Fig. 310-1) Detail 3	1 Electrical Duct (Fig. 310-1) Detail 1	3 Electrical Ducts (Fig. 310-1) Detail 2	6 Electrical Ducts (Fig. 310-1) Detail 3	
AWG MCM	TYPES †RHW, †THW, †XHHW, †USE	TYPES †RHW, †THW, †XHHW, †USE	TYPES †RHW, †THW, †XHHW, †USE	TYPES †RHW, †THW, †XHHW, †USE	TYPES †RHW, †THW, †XHHW, †USE	TYPES †RHW, †THW, †XHHW, †USE	AWG MCM
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
14	24†	22†	16†	....	....	....	14
12	36†	31†	24†	28†	22†	18†	12
10	46†	41†	32†	36†	31†	25†	10
8	63 58 57	61 51 49	57 44 41	49 45 44	47 40 38	45 34 32	8
6	84 77 75	80 67 63	75 56 53	66 60 58	63 52 49	59 44 41	6
4	111 100 98	105 86 81	98 73 67	86 78 76	79 67 63	77 57 52	4
3	129 116 113	122 99 94	113 83 77	101 91 89	83 77 73	84 65 60	3
2	147 132 128	139 112 106	129 93 86	115 103 100	108 87 82	101 73 67	2
1	171 153 148	161 128 121	149 106 98	133 119 115	126 100 94	116 83 97	1
1/0	197 175 169	185 146 137	170 121 111	153 136 132	144 114 107	133 94 97	1/0
2/0	224 200 193	212 166 156	194 136 126	176 156 151	165 130 121	151 106 98	2/0
3/0	260 228 220	243 189 177	222 154 142	203 178 172	189 147 138	173 121 111	3/0
4/0	301 263 253	280 215 201	255 175 161	235 205 198	219 168 157	199 137 126	4/0
250	334 290 279	310 236 220	281 192 176	261 227 218	242 185 172	220 150 137	250
300	373 321 308	344 260 242	310 210 192	293 252 242	272 204 190	245 165 151	300
350	409 351 337	377 283 264	340 228 209	321 276 265	296 222 207	266 179 164	350
400	442 376 361	394 302 280	368 243 223	349 297 284	321 238 220	288 191 174	400
500	503 427 409	460 341 316	412 273 249	397 338 323	364 270 250	326 216 197	500
600	552 468 447	511 371 343	457 296 270	446 373 356	409 296 274	365 236 215	600
700	602 509 486	553 402 371	492 319 291	488 408 389	443 321 297	394 255 232	700
750	632 529 505	574 417 385	509 330 301	508 425 405	461 334 309	409 265 241	750
800	654 544 520	597 428 395	527 338 308	530 439 418	481 344 318	427 273 247	800
900	692 575 549	628 450 415	554 355 323	563 466 444	510 365 337	450 288 261	900
1000	730 605 576	659 472 435	581 372 339	597 494 471	538 385 355	476 304 276	1000

Ampacity of left hand column is for Rho = 60, LF = 50%

Ampacity of right hand column is for Rho = 120, LF = 100%

Ambient Temp. °C	For ambient temperatures other than 20°C (68°F) multiply the ampacities shown above by the appropriate factor shown below.						Ambient Temp. °F
6-10	1.09	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	.90	79-86

†Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum.

Log # 2624

6- 131 - (Tables 310-25, 310-26 and 310-27): Reject
SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Assoc.
RECOMMENDATION: Change "Electrical Duct" to "Raceway".
SUBSTANTIATION: To correlate with companion proposal to change "electrical duct" to "raceway".
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 6-165.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Sallaz, Straniero.
EXPLANATION OF VOTE:
SALLAZ: Same as Proposal 6-50.
STRANIERO: Same as Proposal 6-50.

Log # 1197

6- 132 - (Tables 310-25 through 310-30 and Figure 310-1): Reject
SUBMITTER: Richard J. Marceau, Dynalectric Company of Nevada
RECOMMENDATION: Deletion of Neher-McGrath equation and related tables. Re-establishment of past procedures and tables.
SUBSTANTIATION: The tables are limited in their application by not including large projects. The formula as shown on 310-15b is complicated, involving soil resistance values that are not readily available or arbitrary.
The only other viable option on a 4000A service is to use Detail 3, Figure 310-1 and space the six ductbank arrangement 24" apart in a trench 45" deep x 105" wide; what happens when this duct bank reduced down to terminate in a 38" switchgear section; are we in violation of not maintaining the 24" duct separation?
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 362

6- 133 - (Tables 310-25 through 30, and Accompanying Notes):
Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Amos D. Lowrance, Jr., City of Chattanooga, TN
RECOMMENDATION: Delete Section 310-25 through 30 tables and associated notes. Return us to 310-16, PLEASE!
SUBSTANTIATION: Tables as written are unenforceable. No table is given for a second floor slab. To be enforced as written in tables, slabs would have to be up to thirty (30") inches deep, (several conduits crossing coming from different compass points). Please return us to the good old days of 310-16 until the bugs are worked out of these tables.
PANEL ACTION: Accept in Principle.
PANEL COMMENT: Panel agrees with the recommendation, but does not agree with the substantiation. See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 6
NEGATIVE: Brown, Frasure, McClung, Segall.
EXPLANATION OF VOTE:
BROWN: See my comments on Proposal 6-049.
FRASURE AND SEGALL: No substantiation is given for the claim that the Tables are unenforceable. All objections have been covered in my negative ballot on Proposal 6-49 covering new 1990 Code proposals.
Please refer to my ballots on Proposals 6-61 and 6-62, covering conductors in slabs.

Also refer to my negative ballots on Proposals 6-14, 6-59, and 6-68.

MCCLUNG: There is no substantiation for the tables being unenforceable.

Log # 2627

6- 137 - (Tables 310-25 through 310-27, Note 1): Reject
SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association
RECOMMENDATION: In note 1, change all references to "electrical duct" to "raceway".
SUBSTANTIATION: To correlate with companion proposal to change electrical duct to raceway.
PANEL ACTION: Reject.
PANEL COMMENT: Note is unnecessary in view of Panel Action on Proposal 6-49.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Sallaz, Straniero.
EXPLANATION OF VOTE:
SALLAZ: Same as Proposal 6-50.
STRANIERO: Same as Proposal 6-50.

Log # 1191

6- 138 - (Tables 310-25 through 310-27 and Notes 1, 2 and 3):
Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Robert Harrison, ESI Inc. Electrical Contractors
RECOMMENDATION: Delete Tables 310-25, 310-26, 310-27 and Notes 1, 2, 3.
SUBSTANTIATION: These tables add cost to the electrical installation with no apparent justification. Local Code agency and local design engineers do not understand the need for change. This appears to be overkill.
PANEL ACTION: Accept.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 6
NEGATIVE: Brown, Frasure, McClung, Segall.
EXPLANATION OF VOTE:
BROWN: See my comments on Proposal 6-049.
FRASURE AND SEGALL: The reasons for needing Tables 310-25, 310-26, and 310-27 are documented in my following negative ballots:
6-14, 6-49, 6-59, and 6-68.
MCCLUNG: These tables are needed to provide technically correct values for conductors in underground duct.

Log # 2626

6- 139 - (Tables 310-25 through 310-27 Note 2): Reject
SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association
RECOMMENDATION: In note 2, change all references to "electrical duct" to "raceway".
SUBSTANTIATION: To correlate with companion proposal to change electrical duct to raceway.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 6-143.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 8
NEGATIVE: Sallaz, Straniero.
EXPLANATION OF VOTE:
SALLAZ: Same as Proposal 6-50.
STRANIERO: Same as Proposal 6-50.

Log # 1151

6- 140 - (Tables 310-25 through 310-27, Note 3): Reject
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the heading as indicated:
... Chapter 3 as (Suitable) "Identified" for Use

SUBSTANTIATION: Same as Proposal 6-20.

PANEL ACTION: Reject.

PANEL COMMENT: Section 110-3(a) defines "suitable".

In the Panel's opinion, not all items need to be "identified" when their suitability is acceptable to the authority having jurisdiction.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2625

6- 141 - (Tables 310-25 through 310-27 Note 3 and Note 4-(New)): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Change all references to "electrical duct" to "raceways."

Change 3 to:

3. RACEWAYS IN FIGURE 310-1. Figure 310-1 includes any raceways recognized in Chapter 3 as suitable for use underground, and other raceways, round in cross section, listed for use underground: embedded in earth or concrete.

Add 4. METAL CONDUIT UTILIZED IN FIGURE 310-1. When rigid metal conduit or intermediate metal conduit is used as the raceway in Figure 310-1, the minimum burial depth for all details is 6 inches (152 mm) as permitted by Table 300-5.

SUBSTANTIATION: To correlate with companion proposals regarding the term "electrical duct" and clarify section heading.

PANEL ACTION: Reject.

PANEL COMMENT: All electrical ducts are raceways, but not all raceways are ducts. See the FPN to definition of "raceway" in Article 100. The ampacities are determined using Figure 310-1 are ONLY valid for electrical ducts round in cross section.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Sallaz, Straniero.

EXPLANATION OF VOTE:

SALLAZ: Same as Proposal 6-50.

STRANIERO: Same as Proposal 6-50.

Log # 2536

6- 142 - (Tables 310-25 through 310-27, Notes to Tables 310-25 through 310-27): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Change heading to, "Notes to Tables 310-26 and 310-27".

Eliminate Note 3.

SUBSTANTIATION: Notes 1 and 2 do not apply to Table 310-25.

Note 3 requirements are adequately covered in Section 310-15 (definition of electrical duct) and the "Notes for all details", Figure 310-1.

This should clarify the text.

PANEL ACTION: Reject.

PANEL COMMENT: Note is unnecessary in view of Panel Action on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: I disagree with the panel action and comment on this proposal. If Tables 310-25 through 310-27 are not deleted, then the changes suggested by this proposal are appropriate. See my comments on Proposal 6-049.

FRASURE AND SEGALL: This change should be made to the heading for clarification. These Tables will return to the Code before the 1990 Code cycle is over.

MCCLUNG: I am voting negatively here to indicate this is a desirable action to take if Proposal 6-49, on which I am also voting negatively, fails to be accepted.

Log # 2254

6- 143 - (Tables 310-25 through 310-27, Note 4-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add Note 4 as follows:

4. Criteria Modifications. Where different values of load factor and Rho are known for a particular installation, the ampacities shown in these tables are permitted to be modified to different values by calculation or the use of Figure 310-5.

SUBSTANTIATION: This permits increased ampacity ratings for commercial or industrial installations with less than 100% load factor. Values of Rho that differ from 90 can also be easily utilized.

PANEL ACTION: Reject.

PANEL COMMENT: Note is unnecessary in view of Panel Action on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: This note greatly increases the usability of the Tables and should be added to verify that Figure 310-5 can be used with all these Tables. All of these Tables will reappear in the Code before this Code cycle is complete.

MCCLUNG: Same as Proposal 6-142.

Log # 3299

6- 144 - (Tables 310-25 through 310-27 Note 4-(New)): Accept in Principle

SUBMITTER: Charles E. Williams, Westinghouse Electric Corporation

RECOMMENDATION: Add new note to existing notes pertaining to Tables 310-25 through 310-27 to read as follows:

NOTE 4: ELECTRICAL DUCTS UTILIZED IN FIGURE 310-1.

Spacings between electrical ducts (raceways) as defined in Figure 310-1 shall be permitted to be less than specified in Figure 310-1, where ducts (raceways) enter equipment enclosures from underground, without reducing the ampacity of conductors contained within such ducts (raceways).

SUBSTANTIATION: The spacing shown in Figure 310-1 is constant 7 1/2 inches regardless of duct (raceway) size and underground thermal parameters. Many electrical ducts (raceways) entering equipment enclosures from underground have smaller dimensions to match their installed conductor ampacity requirements. In these cases, to maintain a constant space of 7 1/2 inches between the ducts (raceways) is impractical and wasteful of valuable floor space. The thermal characteristics of rising raceways are such that a less than maximum spacing of 7 1/2 inches can be justified.

The calculations used for underground installations were based on 5 inch duct spaced 7 1/2 inch on centerline. There can be no technical justification for maintaining this 7 1/2 inch spacing as shown in Figure 310-1 for smaller raceways as they enter equipment enclosures from underground.

PANEL ACTION: Accept in Principle.

Add a new Note No. 7 to existing notes pertaining to Tables 310-69 through 310-84 as specified in the proposal.

PANEL COMMENT: To correlate with Panel Action on Proposals 6-49, 6-65, and 6-168.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Brown, Frasure.

EXPLANATION OF VOTE:

BROWN: I agree with the panel action to create a new NOTE to address this issue. However, if Tables 310-25 through 310-30 are not deleted, this new NOTE would also apply to those tables as originally proposed by the submitter. See my comments on Proposal 6-049.

FRASURE: This proposal needs to be accepted. The practice defined is widely practiced and should have official NEC sanction.

Log # 2000

6- 135 - (Table 310-26): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2752

6- 136 - (Table 310-26): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Delete copper conductor sizes No. 8 AWG and smaller and delete aluminum conductor sizes No. 6 AWG and smaller. Insert parenthesis . . . (see Table 310-16 for 60 amperes or less.)
SUBSTANTIATION: The present underground installation ampacity Tables and Figure 310-1 are not being enforced and are not enforceable for feeder and branch circuit installations of 60 amperes or less. Factors such as site layout (gasoline service stations) and low demand factors overrule the heat dissipation advantages of the new Table in favor of workhorse Table 310-16.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2001

6- 145 - (Table 310-27): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2753

6- 146 - (Table 310-27): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Delete copper conductor sizes No. 8 AWG and smaller and delete aluminum conductor sizes No. 6 AWG and smaller. Insert parenthesis . . . (see Table 310-16 for 60 amperes or less.)
SUBSTANTIATION: The present underground installation ampacity Tables and Figure 310-1 are not being enforced and are not enforceable for feeder and branch circuit installations of 60 amperes or less. Factors such as site layout (gasoline service stations) and low demand factors overrule the heat dissipation advantages of the new Tables in favor of workhorse Table 310-16.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3294

6- 147 - (Table 310-27):
 Secretary's Note: It was the action of the Correlating Committee that this proposal be reported as "Reject" because less than two-thirds of the members eligible to vote have voted in the affirmative.
 It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-49. This action will be considered by the Panel as a Public Comment.
SUBMITTER: Marvin J. Lefkowitz, Acme Electric Company, Inc.
RECOMMENDATION: Revert to table 310-16 of 1984 code Standard.
SUBSTANTIATION: As it stands the table severely limits the ampacities of conductors used for a service entrance. Achieving services in excess of 2400 amperes is not feasible. Local Utilities have no provision for the # of conductors required, nor does NEMA standard switch gear accommodate this configuration.

Aside from a theoretical formula, NO Contractors, Electrical Inspectors, or Utilities in our area are aware of recorded burnups due to cable deterioration.

It is a rarity for Residential & Commercial buildings to achieve design ampacities in their respective services when designed in compliance with Article 220.

It is more the rule that these buildings achieve only 35% - 50% design load. We have no way of determining this factor upon initial design. Therefore in an attempt to meet code requirements of this section, the inspectors enforcing the code insist upon 100% load factor being used to determine the feeder sizes.

Have we not downgraded the ampacities of the conductors twice?:

1. Assuming a 100% load factor.
2. The heating effect allowed for in the tables.

If I am remiss, could you please provide me with records of these instances outlining:

1. Type of insulation?
2. Cause ie: were feeders properly installed per code?
3. Where ie: above ground or underground, what part of the country, rooftop installation?
4. Defined analysis of the cause?
5. Were burnups due to insulation deterioration.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-049.

FRASURE AND SEGALL: See my negative ballot on Proposal 6-49 which tabulates all the proposals that permit ampacities up to 5000 amperes in duct banks.

Article 220 is not applicable to most major load installations.

You are correct in saying that not all installations need 100% load factor. Neither do they need a Rho of 90. For most building installations in our area we use a Rho of 60 and a load factor of 50%, verified by calculation. However, most industrial applications require a load factor of 100%. Proposed additions to the Code allow these ampacity changes to be made in new and existing duct bank applications without having to make ampacity calculations.

Please see my negative ballots on the following proposals for verification of the above statements: 6-14, 6-59, 6-68, 6-126.

MCCLUNG: There are many who would return to the "good old days." In the case of ampacity tables that would appear to be pre-1984 which also required its own judgement factors based on application of the Code Article 220 Branch-Circuit and Feeder Calculations. That is a best guess judgement for use when you do not have details with which to work. It usually resulted in oversizing conductors sufficient that a few tables appeared to cover most needs and even allowed the term "free air" to be used in conjunction with table headings that were for cables in raceway in free air or within a wall, floor, or ceiling which is in free air. On Proposal 6-117 for this 1990 NEC, the Panel 6 ruled that such a statement about free air was technically incorrect.

In applying the Tables 310-77 through 310-84 the Proposal 6-49 recognizes the need for Table 310-1 to cover installation dimensions. Such a need does not disappear just because voltage levels change. Such a need is based on thermal properties of the system not on electrical parameters. Table 310-1 is needed for 0 to 2000 volt services also.

In the Proposal 6-49 an effort is made to concede that where in close proximity the conductor operating temperature of more than nine current carrying conductors may need to be considered when applying Table 310-16 to underground installations.

There have been many complaints about using the tables in the 1987 NEC as well as many suggestions for improving the tables in the 1987 NEC. The complaints appear to be one-sided. The suggestions for making the tables in the 1987 NEC more usable are from many interests.

This proposal would make a mockery of 50 years of technical progress just to serve those who refuse to realize that the Code is for all interest groups.

It would appear that the Code could include a set of tables for use when loads are overestimated and a formula for use when loads are accurately tabulated and calculated plus a separate set of tables for use in most instances when loads are accurately tabulated and calculated (not all interested parties that use the Code have the resources to apply the Neher-McGrath calculation method).

In order to satisfy those interests that want to use accurately tabulated and calculated loads and apply technically correct tables, the suggestions for improvement over the 1987 Code as made by new proposals should be implemented. The specific proposals for the 1987 Code that need to be accepted to achieve this objective are Proposal Numbers 6-17, 6-53, 6-61, 6-62, 6-64, 6-65, 6-71, 6-110, 6-122, 6-130, 6-143, 6-155, 6-156, 6-159, 6-164, 6-168, 6-169, 6-171, and 6-172.

Log # 2002

6- 148 - (Table 310-28): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-48.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2754

6- 149 - (Table 310-28): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Delete copper conductor sizes No. 8 AWG and smaller and delete aluminum conductor sizes No. 6 AWG and smaller. Insert parenthesis . . . (see Table 310-16 for 60 amperes or less.)
SUBSTANTIATION: The present underground installation ampacity Tables and Figure 310-1 are not being enforced and are not enforceable for feeder and branch circuit installations of 60 amperes and less. Factors such as site layout (gasoline service stations) and low demand factors overrule the heat dissipation advantages of the new Table in favor of workhorse Table 310-16.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 821

6- 150 - (Table 310-29): Reject
SUBMITTER: William O. Anderson, Jr., Kaiser Aluminum & Chemical Corporation
RECOMMENDATION: Revise Table 310-29 to read:
Triplexed single insulated conductor ampacities, rated 0 through 2000 volts, directly buried in earth, based on an ambient earth temperature of 20°C (68°F) . . .
SUBSTANTIATION: Delete the word "three" from the title. "Three triplexed single insulated conductors" equals a total of nine single conductors. Figure 310-1, Details 7 and 8 depict one or two triplexed bundles.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 9
NEGATIVE: McClung.
EXPLANATION OF VOTE:
MCCLUNG: Same as Proposal 6-142.
COMMENT ON VOTE:
I agree with the Panel action to reject this proposal. I disagree with the submitter's substantiation. Figure 310-1, Details 7 and 8, clearly indicate one or two circuits, not one or two triplexed bundles. In my opinion, the word "three" is necessary and should remain in the title.

Log # 2003

6- 151 - (Table 310-29): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2340

6- 152 - (Table 310-29): Reject
SUBMITTER: Daniel W. VonBerg, Illinois Department of Conservation
RECOMMENDATION: Add a new Line to Table 310-29 for #3 wire size.
SUBSTANTIATION: Although #3 AWG is not the most popular size, it is used and should be included.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2755

6- 153 - (Table 310-29): Reject
SUBMITTER: Ron Wampler, Batavia, OH
RECOMMENDATION: Delete copper conductor sizes No. 8 AWG and smaller and delete aluminum conductor sizes No. 6 AWG and smaller. Insert parenthesis . . . (see Table 310-16 for 60 amperes or less.)
SUBSTANTIATION: The present underground installation ampacity Tables and Figure 310-1 are not being enforced and are not enforceable for feeder and branch circuit installations of 60 amperes and less. Factors such as site layout (gasoline service stations) and low demand factors overrule the heat dissipation advantages of the new Tables in favor of workhorse Table 310-16.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2004

6- 154 - (Table 310-30): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2247

6- 155 - (Table 310-30): Reject
SUBMITTER: J. W. Frasure, Houston, TX
RECOMMENDATION: Add the ampacities as follows to existing Table 310-30.

AWG	Table 310-30							
	CU		AL		CU		AL	
MCM	Detail 9	Detail 10	Detail 9	Detail 10	Detail 9	Detail 10	Detail 9	Detail 10
	60°C	75°C	60°C	75°C	60°C	75°C	60°C	75°C
8		98		92		77		72
6		126		118		98		92
4		163		152		127		118
2		209		194		163		151
1		236		219		184		171
1/0		270		249		210		194
2/0		306		283		239		220
3/0		348		321		272		250
4/0		394		362		307		283
250		429		394		335		308

SUBSTANTIATION: To improve utilization of the existing Table 310-30 in response to requests from the field.
PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: These ampacities were added as a result of several telephone calls from the field. They need to be added to the Table. This Table will reappear in the Code before this cycle is over.

MCCLUNG: Same as Proposal 6-142.

Log # 2260

6- 156 - (Table 310-30): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Change title to "Ampacities of Two or Three Single Insulated . . ."

SUBSTANTIATION: To recognize the use of single phase circuits.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: This change needs to be made in the Table so that it will make the Table more useful in the 1990 Code.

MCCLUNG: Same as Proposal 6-142.

Log # 2537

6- 157 - (Table 310-30): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Add the ampacities shown in the following table to existing Table 310-30.

		Table 310-30							
		CU		AL					
		Detail 9	Detail 10	Detail 9	Detail 10	Detail 9	Detail 10	Detail 9	Detail 10
AWG	MCM	60°C	75°C	60°C	75°C	60°C	75°C	60°C	75°C
8		98		92		77		72	
6		126		118		98		92	
4		163		152		127		118	
2		209		194		163		151	
1		236		219		184		171	
1/0		270		249		210		194	
2/0		306		283		239		220	
3/0		348		321		272		250	
4/0		394		362		307		283	
250		429		394		335		308	

SUBSTANTIATION: To improve utilization of the existing Table 310-30 in response to requests from the field.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Action and Substantiation on Proposal 6-49.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: See my negative ballot on Proposal 6-156.

MCCLUNG: Same as Proposal 6-142.

Log # 2005

6- 158 - (Table 310-31): Accept

SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Change "MCM" to "kcmil" in two places in the Table heading.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2261

6- 159 - (Table 310-31): Accept

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Change Title to, " . . . (For TC, MC, MI, UF, USE, and SNM cables)†"

SUBSTANTIATION: To recognize use of UF and USE cable in these applications.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2389

6- 160 - (Table 310-31): Reject

SUBMITTER: R. P. O'Riley, Innovative Education, Inc.

RECOMMENDATION: Renumber Table 310-31 to Table 310-21 and relocate

SUBSTANTIATION: This editorial change is recommended so as to keep ampacity tables for cable assemblies together, rather than have them separated by the ampacity tables for underground installations.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel does not agree with the substantiation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2803

6- 161 - (Tables 310-31 and 310-16): Reject

SUBMITTER: Thomas E. Trainor, City of San Diego, CA

RECOMMENDATION: Delete Table 310-31, add Cable Types TC, MC, MI, and SNM to those covered by Table 310-16

SUBSTANTIATION: Table 310-31 should be deleted because it is technically inaccurate. There is no way that a single maximum ampacity can be established for these four cable types, all of different construction, which will apply under all installation conditions. To be technically correct, separate ampacity tables would be required for each of the following conditions:

Type TC Cable supported by a messenger

Type TC Cable in raceway

Type MC Cable supported by a messenger

Type MC Cable in raceway

Type MC Cable installed indoors

Type MC Cable installed outdoors

Type MC Cable direct buried

Type MC Cable as open runs of cable

Type MI Cable installed indoors

Type MI Cable installed outdoors

Type MI Cable embedded in plaster, etc, above-grade

Type MI Cable embedded in plaster, etc, below-grade

Type MI Cable in underground runs

Type SNM Cable in raceway

This list may not be complete but it serves to make the point.

It is a practical and reasonable compromise to apply the ampacities of Table 310-16 to these cables. Table 310-16 provides ampacity ratings which have proven safe under all of these installation conditions and which are consistent with the ampacity ratings of electrical equipment terminations.

The need to develop 14 new ampacity tables for just 4 cable types points out the impracticality of applying the "technically correct" Neher-McGrath method.

PANEL ACTION: Reject.

PANEL COMMENT: The conditions for use of Table 310-31 are vastly different from Table 310-16.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1210

6- 81 - (Table 310-16 through 310-31, Note 3): Reject

SUBMITTER: K. V. Jester, Desoto, TX

RECOMMENDATION: Change this section to read:

Conductors as listed below, shall be permitted to be utilized as three wire, single phase service entrance and/or feeder conductors where such conductors supply the entire load of a single dwelling unit or mobile home. Grounded conductors shall be permitted to be smaller than the ungrounded conductors provided the requirements of 230-42 and 220-22 are met.

SUBSTANTIATION: The diversity of the load (dwellings) being supplied should be the basis for allowing the ampacity rating in Note 3 rather than where those loads are being supplied from. The extended ampacity ratings should be allowed for the conductors which supply an individual dwelling unit or mobile home regardless of whether they receive their supply from a service drop, lateral or distribution panelboard. The way many inspection authorities interpret the present Code wording prevents a 40 unit multi-family dwelling with individual sets of service entrance conductors (one set to each unit) from taking advantage of Note 3 because each set of S.E. conductors do not carry the total current supplied by the service drop or lateral.

Reducing the size of the neutral or grounded conductor two sizes automatically could result in this conductor being oversized in some cases and undersized in others. The sizing of these conductors is already adequately covered by Code Section 230-42 for services and 220-22 for feeders.

PANEL ACTION: Reject.

PANEL COMMENT: Note 3 as presently written requires confirmation with Articles 220 and 230.

Mobile homes are presently allowed the use of Note 3 under Section 215-2.

Diversity of load can not be considered as a basis for sizing conductors in Note 3.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2172

6- 82 - (Tables 310-16 through 310-31, Note 3): Accept
SUBMITTER: Peter Pollak, The Aluminum Association, Inc.

RECOMMENDATION: Under 3. Three-Wire, Single-Phase Dwelling Services, add "USE" to the table heading so that it reads:

"Conductor Types and Sizes

RH-RHH-RHW-THW-THWN-THHN-XHHW-USE"

SUBSTANTIATION: Triplexed USE conductors are a very popular form of single-phase dwelling service. USE should be added to this table heading to help users arrive at the proper rating for the intended use.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1401

6- 83 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: W. Creighton Schwan, Hayward, CA

RECOMMENDATION: REVISE the first sentence as follows:

NEW material in quotations and DELETED material in parenthesis:

Three-Wire, Single-Phase Dwelling Services. In dwelling units, conductors, as listed below, shall be permitted to be utilized as three-wire, single-phase, service-entrance conductors and [the] three-wire, single-phase feeder"s." (that carries the total current supplied by that service).

SUBSTANTIATION: The service equipment for dwellings often provides a means for adding future load. If Note 3 is used for a service serving only one feeder, and the feeder conductors are selected per Note 3, and at a later date a circuit for a swimming pool is taken from the service location, the installation is then in violation of the (1987) Code, because the feeder no longer carries "the total current supplied by that service". A technical violation, but not a lower standard of safety, assuming the load calculations permit the added load.

Note 3 is applicable only to feeders of 100 amperes or more, so the diversity contemplated in the rule is going to be present whether some additional load is taken off ahead of the feeder or not.

Why handcuff the owner and the installer by a rule which is overly restrictive?

PANEL ACTION: Accept in Principle.

Revise the proposal to read as follows:

"3. 120/240 Volts, Three-Wire, Single-Phase Dwelling Services. In dwelling units, conductors, as listed below, shall be permitted to be utilized as 120/240 volt, three-wire, single-phase service-entrance conductors and feeder conductors in raceway or cable

with or without an equipment grounding conductor. The grounded conductor shall be permitted to be not more than two AWG sizes smaller than the ungrounded conductors for application of this note, provided the requirements of Sections 215-2, 220-22 and 230-42 are met.

PANEL COMMENT: The Panel believes the revised wording satisfies the intent of the proposal.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 333

6- 84 - (Tables 310-16 through 310-31, Note 3): Reject

SUBMITTER: Richard E. Loyd, Arkansas Department of Labor

RECOMMENDATION: Revise as follows:

Grounded service conductors shall be permitted to be two AWG sizes smaller than the ungrounded conductor provided no more than 80% of the load to be served are single pole, overcurrent devices utilizing the neutral conductor and the requirements of Section 230-42 are met.

SUBSTANTIATION: I see no problem in dwelling units utilizing a reduced neutral provided that at least a portion of the load is 240 volts, such as electric dryers, water heaters, electric ranges, electric heat, etc. However, we are beginning to see all gas homes in these installations. The reduction allowed to the ungrounded conductors should not be further reduced.

PANEL ACTION: Reject.

PANEL COMMENT: No technical substantiation for the 80% value in the proposal. See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1625

6- 85 - (Tables 310-16 through 310-31, Note 3, FPN-(New)): Reject

SUBMITTER: Joe Tedesco, Norwell, MA

RECOMMENDATION: Add (FPN) as follows:

"See Section 338-5 for Type SE cable marking requirements where the neutral conductor is smaller than the ungrounded conductors."

SUBSTANTIATION: Based upon tests which have been conducted by UL, involving the maximum heating that can be produced, an uninsulated conductor employed in a service cable assembly is considered to have the same current-carrying capacity as the insulated conductors even though it may be smaller in size.

PANEL ACTION: Reject.

PANEL COMMENT: Panel believes a fine print note is not necessary. Note 3 does not contain marking requirements.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1666

6- 86 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Edward C. Lawry, Madison, WI

RECOMMENDATION: Revise Note 3 heading and first sentence to read:

"3. Three-Wire, Single-Phase Dwelling Services or Feeders. Conductors, as listed below, shall be permitted to be utilized as three-wire, single-phase, service-entrance or feeder conductors supplying individual dwelling units."

Revise heading of Column 3 in Note 3 Table to read:

"Service or Feeder"

Rating in Amps

SUBSTANTIATION: The present Code permits Note 3 to be utilized for feeder conductors carrying the total current supplied by a service. If it is safe to use the Note 3 conductors for feeders carrying the total current supplied by a service, then it should be safe for the same feeder in a multi-occupancy building. The load in the dwelling unit is the same and the conductor doesn't know if it is a service conductor, a feeder conductor carrying the total current supplied by a service or a feeder conductor not carrying total current of a service.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1964

6- 87 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Olaf G. Ferm, Ferm's Fast Finder Index.

RECOMMENDATION: Add the following wire sizes and ampacities to Note 3:

	Aluminum Copper-Clad AL	Service Rating in Amps
Copper	250 MCM	225
3/0	300 MCM	250
4/0	350 MCM	275
250 MCM	400 MCM	300
300 MCM	500 MCM	325
350 MCM		

SUBSTANTIATION: The calculated load for many dwellings exceeds 200 amps. At the present time there are 400 amp line voltage meter bases on the market. These wire sizes and ampacities would be compatible with the lugs furnished with these meter bases and would be more than adequate to supply the actual load.

PANEL ACTION: Accept in Principle.

Revise the table as shown below and add it to the existing table. Change "MCM" to "kcmil" in existing table.

	Aluminum Copper-Clad AL	Service Rating in Amps
Copper	250	225
3/0	300	250
4/0	350 kcmil	300
250 kcmil	500 kcmil	350
350 kcmil	600 kcmil	400
400 kcmil		

PANEL COMMENT: We agree with submitter's substantiation and Panel has expanded the table to 400 ampere service rating.

Ampacities are based upon 75°C ratings from Table 310-16 multiplied by 0.875 to account for the fact that only two of the conductors carry rated current. Ampacities have been adjusted to nearest standard overcurrent ratings.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: The second paragraph of the panel comment is incorrect in that it calls for the 75 C ratings from Table 310-16 to be MULTIPLIED by the factor 0.875 when actually the 75 C ratings should be DIVIDED by the factor 0.875 to account for the fact that only two of the conductors carry rated current.

Log # 2366

6- 88 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Joseph McCann, City of Coral Springs, FL

RECOMMENDATION: Deleted text:

Three wire, single phase dwelling services. In dwelling units, conductors, as listed below, shall be permitted to be utilized as three wire, single phase, service entrance conductors and the three wire single phase feeder.

(Delete) "That carries the total current supplied by that service."

SUBSTANTIATION: Many times a time clock, solenoid, sprinkler pump is added at the service out of a load center. The feeder going into the dwelling no longer carries the total supplied by that service, disallowing the inspector from using the conductors in Note 3. Since the feeder going inside is now carrying less current, it only makes sense that Note 3 could be used on these feeders.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2534

6- 89 - (Tables 310-16 through 310-31, Note 3): Reject
Secretary's Note: The Correlating Committee directs CMP 6 to act on the Proposal based on its merits. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Revise paragraph 3 to read as follows:

Duplex, triplex, or quadruplex aerial service entrance conductors shall be permitted to have ampacities as listed in Table 310-23. Grounded service entrance conductors shall . . .

Delete the table shown in this paragraph.

SUBSTANTIATION: The existing table is void of utilization parameters. It does not provide for all the types of service entrance conductors commonly used today. It does not indicate the allowable temperature rating of the conductors nor the effect of ambient temperature on the ampacity. For example: Is the existing table good for 75 or 90 degrees C conductors? Is the ampacity shown good at an ambient of 30, 40, or 50 degrees C?

The attached table from the "Aluminum Handbook" confirms that the ampacities listed in Table 310-23 are equal to or less than the application ampacities recommended for these types of cable by the cable manufacturers.

NOTE: Supporting Material Available For Review At NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Note 3 does not pertain to service drops.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2756

6- 90 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Ron Wampler, Batavia, OH

RECOMMENDATION: Revise the end of the first sentence: ". . . and the three-wire, single-phase feeder that carried the total current supplied to a dwelling unit."

SUBSTANTIATION: A dwelling unit feeder sees that same load diversity regardless of whether part of an apartment building or a single family residence. This proposal will legitimize what authorities having jurisdiction are allowing.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2828

6- 91 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: George O. Stiles, Stiles Electric Service

RECOMMENDATION: Insert term "120-240 volt" between the words single-phase and dwelling services, to read

"Three wire, single-phase 120-240 volt dwelling services".

SUBSTANTIATION: In a 120-240 volt single-phase system, the Neutral Conductor carries the unbalanced current from the phase conductors. The total current flow never exceeds the equivalent of two fully loaded conductors. Many authorities state that this principle is the basis for Note 3.

A formula for calculating the Neutral current in a wye system is

$$\sqrt{I^2A + I^2B + I^2C - (IA IB) - (IB IC) - (IC IA)}.$$

In an unbalanced circuit, the neutral current computes to nearly the difference between the amperage in the highest and the lowest phase conductors. In a 120-208 volt 3-wire system in which two phase wires and a neutral are tapped from a 4-wire wye system, one phase conductor is not present and appears in the formula as a zero. In this system, fully loaded phase conductors will result in three nearly loaded conductors with a much greater heating effect than if the same load was to be supplied by a 120-240 volt circuit.

Application of Note 3 should be limited to use on 120-240 volt systems to minimize heating and voltage drop problems.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2884

6- 92 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Paul E. Phelan, New Hampshire Electrical Contractors Assoc., Inc.

RECOMMENDATION: Revised text:

3 Three-Wire, Single Phase Dwelling Services.

Ungrounded service entrance conductors that supply dwelling units from a 3 wire single phase source shall be permitted to be sized as in the following table.

Ungrounded Feeders that carry the total current of these ungrounded service entrance conductors shall not be required to have a greater ampacity than the ungrounded service entrance conductors.

Grounded service entrance conductors shall be permitted to be two wire sizes smaller than the ungrounded conductors provided the requirements of Section 230 - 42(c) are met.

Grounded Feeders that carry the total current of the grounded service entrance conductors shall not be required to have a greater ampacity than the grounded service conductors.

The dwelling units may be in a 1, 2 or multi family structure See Art 100 Dwelling.

SUBSTANTIATION: There is widespread misunderstanding as to what note 3 actually permits and does not permit.

In keeping with reasonable demand factors for dwellings and the appropriate ground fault and short circuit protection for feeders as provided elsewhere in this Code I believe this, as re-written, is the intent of note 3.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3404

6- 93 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Bryan W. Vaughan, National Association of Home Builders

RECOMMENDATION: Revised as follows:

Notes to Tables 310-16 through 310-31

3. Three-Wire, Single-Phase Dwelling Services.

In dwelling units, conductors, as listed below, shall be permitted to be utilized as three-wire, single-phase, service-entrance conductors "or as" the three-wire, single-phase feeder "conductors" that carries the total current supplied by that service. Grounded service-entrance conductors shall be permitted to be two AWG sizes smaller than the ungrounded conductors provided the requirements of Section 230-42 are met.

Note: Revised or added material in quotations.

SUBSTANTIATION: Due to widespread varied application of Note 3, it is necessary to clarify the intent of Note 3, which is to permit, conductors carrying the total current supplied to a dwelling unit, to utilize the conductor ampere rating of Note 3.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-83.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3452

6- 94 - (Tables 310-16 through 310-31, Note 3): Accept in Principle

SUBMITTER: Paul A. Walach, Derry, NH

RECOMMENDATION: I would like to see adopted and expansion of note three Table 310-16 to recognize 300

ampere of even a 400 ampere single phase residential service.

I would like it to read 4/0 Cu THHN for 300 amperes or better.

SUBSTANTIATION: Take Cu THHN with an ampacity of 260 amperes as per table 310-16 of the 1987 NEC. In my experience when I've installed 400 ampere services in dwellings, with total connected load of around 300 amperes continuous load, the supplying utility brings in wires rated for around 250 amperes. I've yet to see these wires over heat

Furthermore I've even seen many installation of underground 4/0 copper being fed from the utility side through a distribution point in the street to the premises wiring terminal box inside, and then getting connected up with parallel sets of 3/0 Cu THHN of equivalent to a 400 ampere single or 3 phase commercial service.

I'm only putting emphases on Cu instead of aluminum, and I will leave the decision up the the Code making panel for aluminum equivalent.

It seems like to me that the higher the ampacity for residential services (above 200 amperes) the more favorable conditions exist for demand and diversity. It is similar for tables on domestic dryer and counter cook tops.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Action and Panel Comment on Proposal 6-87.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 115

6- 95 - (Tables 310-16 through 310-31, Note 8, Exceptions No. 3 and 4): Accept

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the first line in exception No. 3 and 4 as indicated:

... factors (do) "shall" not apply ...

SUBSTANTIATION: These changes are required to conform to the 1984 NEC Style Manual, Part A, A-1a.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2817

6- 96 - (Tables 310-16 through 310-31, Note 8(a)): Reject

SUBMITTER: Larry E. Fuhrman, Titusville, FL

RECOMMENDATION: Revise text:

8. More than 3 "current carrying" conductors in a raceway or cable.

Note: Added material in quotations.

SUBSTANTIATION: Note 8 makes no reference to exception of neutral conductor in Note 10 and grounding conductor in Note 11 when applying Note 8 derating factors to No. of conductor in raceway.

PANEL ACTION: Reject.

PANEL COMMENT: Notes 10 and 11 presently cover requirements for neutral and grounding conductors.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2535

6- 97 - (Tables 310-16 through 310-31, Note 8(a)): Accept in Principle

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Insert the following below the existing Table.

For ten or more conductors in the above chart, where the number of energized conductors is other than 50 percent of the total number of conductors, the ampacity of the energized conductors can be calculated from the following formula:

$$A_2 = \sqrt{0.5 N/E} (A_1) \text{ where,}$$

- A_1 = Table ampacity times factor obtained from the chart above.
 N = Total number of conductors in the raceway or cable
 E = Desired number of energized conductors
 A_2 = Ampacity limit for energized conductors

SUBSTANTIATION: The existing chart for more than ten conductors is useful only when half the conductors are energized. This formula permits an ampacity to be developed for any number of energized conductors.

Attached are two computer generated graphs. Attachment No. 1. Wire Derating with 50% Diversity, and Attachment No. 2. Wire Derating with No Diversity. Attachment No. 1 was generated to show that the factors in the 1984 and previous Codes were not correct unless diversity was considered. Attachment No. 1 was generated with 50% of the conductors energized (where ten or more conductors were considered) and 50% de-energized (considered as control conductors with only 1-2 amperes of current). What this showed was that the cables would overheat without such diversity.

Attachment No. 2 shows the derating factors that would be necessary if there was no diversity. You can see that you would need about a 35% derating factor for 60 energized cables.

Now let's look at what people are trying to do. They want to use the table in the Code to account for the case where no diversity exists. (Diversity here means the percent of energized conductors in the raceway.) Such a table is derived from the curves of Attachment No. 2 and is as follows:

No. of Conductors	Percent of Values in Tables
4-6	80
7-9	70
10-20	50
21-30	45
31-40	40
41-60	35

To attack the problem of other diversities, assume 30 conductors in one raceway with a table ampacity rating of 10 amperes and a resistance of one ohm. Per Note 8(a) of the Code, the percent of table ampacity is 60%. Therefore, 15 conductors are rated at 6 amperes and 15 at zero amperes (50% diversity).

Total Allowable Heat in Conduit or Raceway is Proportional to $\sum I^2 R$
 $= 15 (6)^2 (1) = 540 \text{ W}$

This heating cannot be exceeded for any other combination of conductors and conductor ampacities.

For example, energizing 25 of the 30 conductors at 50% of table ampacity,
 $= 25 (5)^2 (1) = 625 \text{ W} = \text{too much}$

Similarly, all 30 could NOT be energized at 50% of table rating,
 $= 30 (5)^2 (1) = 750 \text{ W}$

What would be permissible would be for 30 conductors to be energized at 1/2 the heating of the 15 conductors. Thus the total heating in the conduit would remain the same.

Heat in each of the 15 conductors $= (6)^2 \times 1 = 36 \text{ W}$

Each of the 30 conductors could then have

$36/2 = 18 \text{ W}$ of heating.

Since $R = 1$, the allowable ampacity would be $\sqrt{18} = 4.24$ amperes or 42.4% of table ampacity

Since this is the same as 42% derating on a conduit with no diversity, we can look on Attachment No. 2, Curve 1, and read 30 cables opposite 42.4% derating. So the curves check and the method is verified.

We can now develop the following procedure as an alternative to adding the "no diversity" table. It would also have a broader application.

1. Assume all conductors are the same size and temperature rating.
2. Assume number of conductors is ten or more.
3. Resistance of each conductor is ESSENTIALLY the same.

1. Derate factor per Table 8a is for 50% diversity. (Half the total number of conductors energized.)

Therefore cable ampacity at 50% diversity

$(A_1) = \text{Table rating} \times 8a \text{ factor for } 1/2 \text{ the number of conductors } (N) \text{ used to enter Table 8a.}$

For any number of cables up to the total, the ampacity can be calculated as follows:

Total allowable raceway heating $= A_1^2 \times \frac{N}{2} \times R$

Any other ampacity combination must equal this value, so, what is the maximum ampacity of 3/4 N conductors?

$$X A_1^2 \times \frac{N}{2} = A_2^2 \times \frac{3N}{4} \times R$$

$$A_2^2 = A_1^2 \times \frac{.5N}{.75N} = .6667 A_1^2$$

$$A_2 = \sqrt{.6667 A_1^2} = 816 A_1$$

This leads to the general formula,

$$A_2 = \sqrt{(X)} (A_1) \text{ where,}$$

$$X = \frac{0.5}{\frac{\text{No of current carrying conductors}}{\text{Total No. of conductors}}} = \frac{.5N}{E}$$

E = Desired number of loaded conductors

This can be restated thus: (For 10 or more conductors)

$$A_2 = \sqrt{0.5 \frac{N}{E}} (A_1) \text{ where,}$$

A_1 = Table ampacity times factor from Note 8a.

N = Total number of conductors used to obtain factor from Note 8a

E = Desired number of energized conductors

A_2 = Ampacity limit for energized conductors

(Artwork shown on following page.)

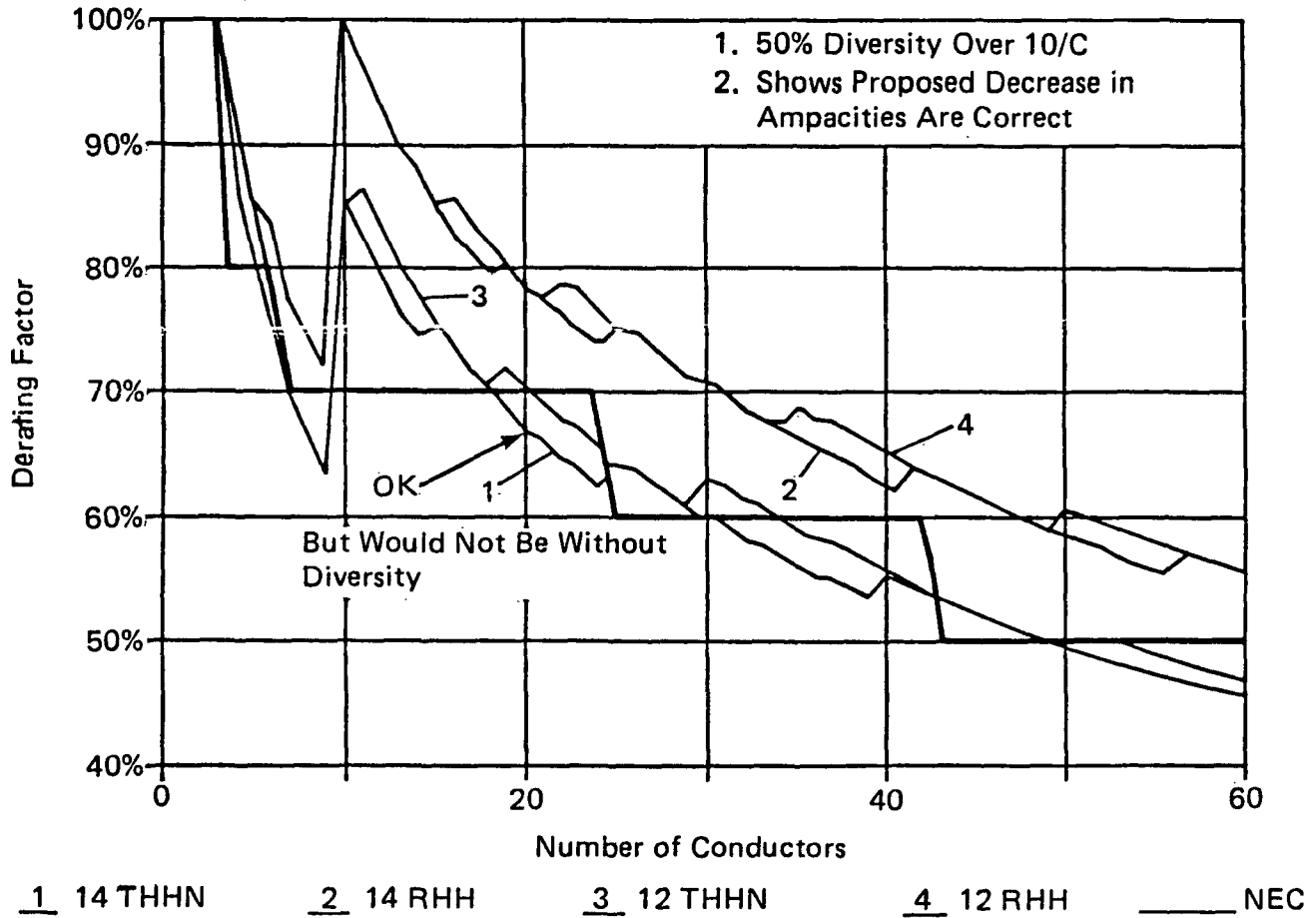
PANEL ACTION: Accept in Principle.

PANEL COMMENT: The Panel believes the action taken on Proposal 6-98 satisfies proposer's intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

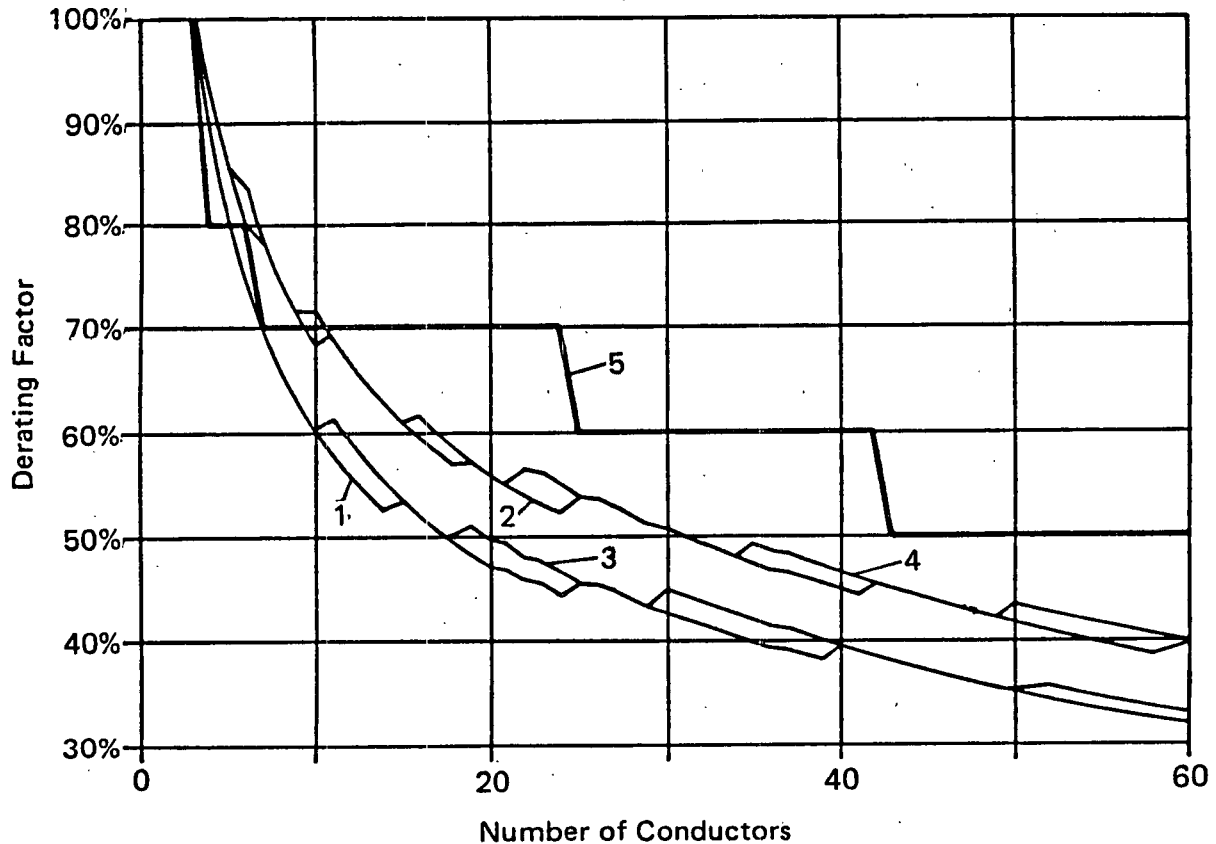
N—M Calculations vs. ICEA/NEC factors

Wires in Conduit, 75 C wire, 40 C amb.



N-M Calculations vs. ICEA/NEC factors

Wires In Conduit, 75 C wire, 40 C amb



1 #14 THHN 2 #14 RHH 3 #12 THHN 4 #12 RHH 5 NEC/ICEA

Log # 2805

6- 98 - (Tables 310-16 through 310-31, Note 8(a)):

Accept

SUBMITTER: John Lipsey, Gulfport, MS

RECOMMENDATION: Add additional column to note 8(a) to Tables 310-16 through 310-31. Column listing number of conductors to remain as printed. Use present "Percent of Values in Tables" as Column "A" and add new column "B". Table should read as follows:

Column "A"	Column B**
Percent of Values in Tables	Percent of Values in Tables
310-16, 310-18, 310-22,	310-16, 310-18, 310-22,
310-26 310-27, 310-28,	310-26 310-27, 310-28,
310-29, 310-30 and	310-29, 310-30 and
310-31, as adjusted for	310-31, as adjusted for
Ambient Temperature if	Ambient Temperature if
Necessary	Necessary

Number of Conductors		Number of Conductors	
4 thru 6	80	4 thru 6	80
7 thru 9	70	7 thru 9	70
10 thru 24*	70	10 thru 20	50
25 thru 42*	60	21 thru 30	45
43 and above*	50	31 thru 40	40
		41 thru 60	35

Column "A"

*These factors include the effects of a load diversity of 50 percent.

**Column "B" - No diversity

F.P.N. Column "A" is based on the following formula:

$$A_2 = \sqrt{0.5 \frac{N}{E}} \times (A_1) \text{ where}$$

A_1 = Table ampacity multiplied by factor from Note 8(a)

N = Total number of conductors used to obtain factor from Note 8(a)

E = Desired number of energized conductors

A_2 = Ampacity limit for energized conductors

SUBSTANTIATION: It has come to my attention that there is a misunderstanding of Note 8(a) to the Tables in Article 310. As shown in the 1987 NEC there is a .50% diversity when 10 or more conductors are in a raceway or cable. This means that 50% of the conductors (when 10 or more are considered) are energized and 50% are NOT energized.

Submitted material has been reproduced as received.
See note on Page 1.

Diversity is defined in the current issue of the IEEE dictionary as follows:

diversity factor (system diversity factor) - The rates of the sum of the individual maximum demands of the various subdivisions of a system to the maximum demand of the whole system. Note: The diversity factor of a part of the system may be similarly defined as the rates of the sum of the individual maximum demands of the various subdivision of the part of the system under consideration.

Due to the misunderstanding of many inspectors and contractors on the use of the Note 8(a) and the load diversity of 50% for 10 or more conductors, I feel that this T.I.A. should be expedited on an emergency basis. As shown in the substantiation it is not correct to load all the conductors to 50%. This thinking can and will cause overheating in the wiring system.

Copies of two computer generated graphs are attached. Attachment No. 1 shows that the factors in the 1984 and previous Codes were not correct unless diversity was considered. This graph was generated with 50% of the conductors energized (10 or more conductors) and 50% de-energized. The graph shows that the conductors will overheat without such diversity. Attachment No. 2 shows the derating factors (See column "B" of proposed T.I.A.) that are necessary if there is no diversity. For 60 energized conductors the derating factor would be about 35%.

Here is an example. Assume 30 conductors in a raceway with a table ampacity rating of 10 amperes and a resistance of one ohm. From Note 8(a) the percent of table ampacity is 60%. Therefore 15 conductors are rated with 6 amperes and 15 conductors at zero amperes (50% diversity). Total allowable heat in the raceway is proportional to $\sum I^2 R$. $\therefore 15 (6)^2 \times (1) = 540W$

This heating shall not be exceeded by any other combination of conductors or conductor ampacities. If we energized 25 of the 30 conductors at 50% of table ampacity then $25 (5)^2 \times (1) = 625 W$, which is higher than the allowable heat of 540 W. If all 30 were energized at 50% of table ampacity then $30(5)^2 (1) = 750W$, also beyond the 540 W limit.

If all 30 conductors had to be energized it would be permissible to energize the 30 conductors at 1/2 the heating of the 15 conductors. This would permit the heating of the raceway to remain the same.

Heat in each of the 15 conductors = $(6)^2 \times 1 = 36 W$

Each of the 30 conductors could have $36/2 = 18W$ of heating.

Since $R=1$, the allowable ampacity would be the square root of 18 or 4.24 amperes or 42.4% derating.

Note that this checks with the curves.

This is the development of the F.P.N equation from which Column "A" is determined. Several assumptions are made:

1. All conductors are the same size and have the same temperature rating.
2. There are 10 or more conductors.
3. Resistance of each conductor is essentially the same.

A. Derate factor per Table 8(a) is for 50% diversity. (1/2 the total number of conductors energized)

Therefore, conductor ampacity at 50% diversity. (A) = Table rating \times 8(a) factor for 1/2 the number of conductors (N) used to enter Table 8(a).

For any number of conductors up to the total, the ampacity can be calculated as follows:

Total allowable raceway heating equals $A^2 \times \frac{N}{2} \times R$

Any other ampacity combination must equal this value
The maximum ampacity for $3/4 N$ conductors is:

$$R \times A^2 \times \frac{N}{2} = A^2 \times \frac{3}{4} N \times R$$

$$A = A \times 0.5 = 0.6667A$$

$$A_2 = \sqrt{0.6667A^2} = 0.816A_1$$

This leads to the general formula:

$$A_2 = \sqrt{x} (A_1) \text{ where}$$

$$x = \frac{0.5}{\frac{\text{No. of current carrying conductors}}{\text{Total No. of Conductors}}} = \frac{0.5N}{E}$$

E = Desired number of loaded current carrying conductors.

This can be rewritten (for 10 or more conductors)

$$A_2 = \sqrt{\frac{0.5N}{E}} (A_1) \text{ where}$$

A₁ = Table ampacity times factor from Note 8(a)

N = Total number of conductors used to obtain factor from Note 8(a)

E = Desired number of energized conductors

A₂ = Ampacity limit for energized conductors

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Accept.

PANEL COMMENT: Tables subject to correlation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3000

6- 99 - (Tables 310-16 through 310-31, Note 8(a)):

Accept in Principle

SUBMITTER: Frederic P. Hartwell, Amherst, MA

RECOMMENDATION: Make the present second paragraph a third paragraph, and add a new second paragraph and exception as follows:

Where the number of conductors in the raceway or cable exceeds 9, and where the continuous diversity is less than 50%, the values given in the above table shall be multiplied by a correction factor computed as follows:

$$f = \sqrt{N_T / 2N_E}$$

N_T = number of conductors in the raceway or cable

N_E = maximum number of simultaneously and continuously energized conductors above 10% of their ampacity.

Exception: Where the number of conductors in a raceway or cable expected to operate without diversity is 10 through 12, the correction factor shall be permitted to be 0.86.

SUBSTANTIATION: There will undoubtedly be several proposals to "operationalize" the asterisk note that was added to the 1987 Code, generally based on the I²R relationship to heat produced in a conductor, as this proposal is as well. This proposal offers several advantages. First, it recognizes an additional three phase circuit (10-12 conductors) more favorably than most, which is justified by careful analysis of the actual ICEA graphs. Second, it can be applied to any diversity situation precisely; one conductor over the fifty percent limit does not produce a dramatic further penalty. Third, it uses the current and familiar cut points for calculations. Fourth, it requires continuous loading to trigger its provisions, which means that it will not be overused. Fifth, it is not triggered below 10% of conductor ampacity. This is very important because in many instances control conductors carrying sealed coil currents are continuously energized but not actually contributing any significant heat. This is because current at 10% of ampacity produces only 1% of the heat produced at full ampacity; the ICEA tables assume similar current values in the unloaded conductors. If this or a similar proposal is not accepted, then the asterisk note should be deleted (see companion proposal). It is not proper to leave a note in the Code saying a provision doesn't apply in some cases, and then give no guidance as to what does apply in those cases. In the mean time, this inspector has been applying the above proposal when necessary. The proposal, when graphed against ICEA ampacities at 0% diversity, almost perfectly mirrors the existing Code graphed against the ICEA ampacities at 50% diversity, and should prove equally safe.

PANEL ACTION: Accept in Principle.

PANEL COMMENT: See Panel Comment on Proposal 6-98.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: I have voted affirmative on the panel action to accept this proposal in principle but I feel the panel comment should read "see panel action on Proposal 6-98" rather than "see panel comment on Proposal 6-98."

Log # 3001

6- 100 - (Tables 310-16 through 310-31, Note 8(a), Exception No. 4): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Delete the words "Schedule 80".
SUBSTANTIATION: Schedule 80, having a thicker wall, will dissipate heat even less rapidly than Schedule 40, and it is not appropriate to specify it in this exception.
PANEL ACTION: Reject.
PANEL COMMENT: The intent of referencing specific raceway types was to recognize the types recognized by Section 300-5(d).
Heat dissipation of the raceway is not a factor in a 10-foot length.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3002

6- 101 - (Tables 310-16 through 310-31, Note 8(a)): Reject
SUBMITTER: Frederic P. Hartwell, Amherst, MA
RECOMMENDATION: Delete the asterisk note
SUBSTANTIATION: The note opens Pandora's Box; the submitter has been applying the formula given in his accompanying proposal, but even that leads to unfair results in some cases, particularly when there is no diversity but partial loading. For example, 0% diversity at one half loading produces only one half the heat of 50% diversity fully loaded, but the Code would more severely penalize the installation with 0% diversity. The submitter believes that the lack of documented failures due to insufficient diversity over the last fifty odd years that the note has been in the Code may be sufficient justification to leave well enough alone.
PANEL ACTION: Reject.
PANEL COMMENT: See Panel Comment on Proposal 6-98.
VOTE ON PANEL ACTION: Unanimously Affirmative.
COMMENT ON VOTE:
COFFEY: I have voted affirmative on the panel action to reject this proposal but I feel the panel comment should read "see panel action on Proposal 6-98" rather than, "see panel comment on Proposal 6-98."

Log # 3345

6- 102 - (Tables 310-16 through 310-31, Note 8(a)): Reject
SUBMITTER: S. Zackerman, Cincinnati, OH
RECOMMENDATION: In the table of derating factors:
(1) Delete the asterisks.
(2) Delete the footnote.
(3) Assign a derating factor of 70% for 7 through 24 conductors.
SUBSTANTIATION: The changes made in the 1987 NEC to the ampacity derating methodology resemble those made for the 1981 NEC, which were abandoned for the 1984 NEC. In the 1981 NEC, it was assumed that it was logical to derate on the basis of "maximum allowable load current" (whatever that may have been intended to mean), while in the 1987 NEC it was assumed that it was logical to derate on the basis of 50% load diversity (whatever that may have been intended to mean). In both instances, the CMP has strayed from the intuitively obvious, and the explicitly defined, concept of ampacity. Ampacity is a fact, and this fact cannot be altered by assumptions about demand factor (i.e., "diversity") based on an honor system. Suppose that a raceway contains 25 current-carrying conductors that stubbornly refuse to exhibit a "load diversity" of 50%. How then DOES one determine the allowable ampacity if the derating factor is based on 50% load diversity? If experience or test can show that the derating factors we have used for many years are wrong, it is appropriate to change them, but not by establishing arbitrary operational modes based on diversity.
PANEL ACTION: Reject.
PANEL COMMENT: Ampacity of multiple conductors should be derated based on load diversity so that heat dissipation is assured. Derating based on 50% load diversity only is no longer mandatory. Derating based

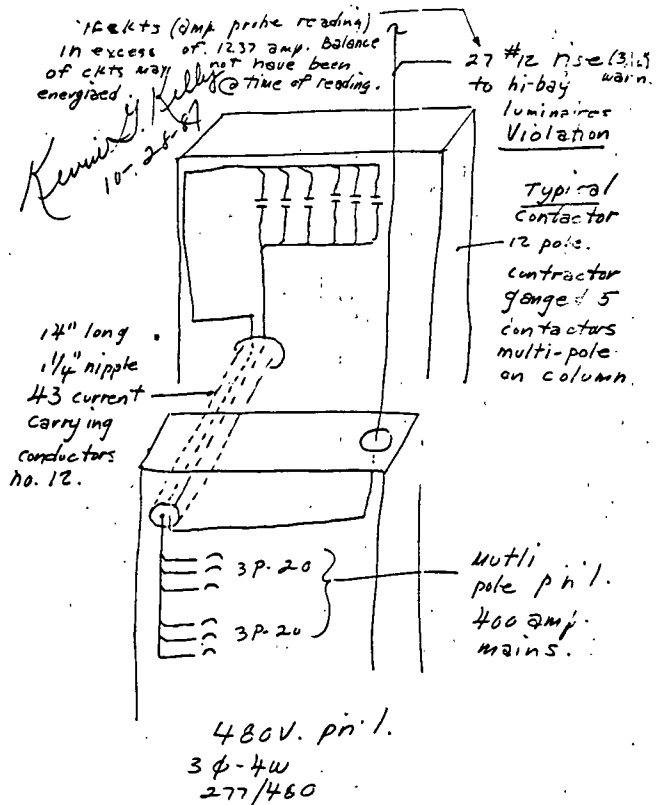
on actual load diversity will be mandatory. See Panel Action and Panel Comment on Proposal 6-98.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 661

6- 103 - (Tables 310-16 through 310-31, Note 8(a), Exception No. 1): Accept
SUBMITTER: Dan Leaf, Westlake Village, CA
RECOMMENDATION: Add: "or cable" after "Raceway".
SUBSTANTIATION: Note 8 applies to cables and a multiconductor cable may contain conductors of different systems.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2218

6- 104 - (Tables 310-16 through 310-31, Note 8(a), Exception No. 3): Reject
SUBMITTER: Kevin G. Kelly, Seattle, WA
RECOMMENDATION: Delete exception no. 3 All wires that are current carrying should be DERATED pursuant to table (see 1(a) above regardless of nipple length).
SUBSTANTIATION:



Nipple running VERY warm..
REMEDY: By using derating tables & table 310-16 & Table 36, pg. 70-720, could have installed 43 no. 8 75°C 'n 2 1/2" C.

PANEL ACTION: Reject.
PANEL COMMENT: In the Panel's opinion, twenty-four inches does not constitute a distance requiring derating.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 746

6- 105 - (Tables 310-16 through 310-31, Note 8(a), Exception No. 4): Accept

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposals 6-58 and 6-110. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Nicholas R. Rafferty, Wilmington, DE

RECOMMENDATION: Change wording from "having a length not exceeding 10 feet (3.05 m) and the number of conductors does not exceed 4." to "having a length not exceeding 10 feet (3.05 m) above grade and the number of conductors does not exceed 4."

SUBSTANTIATION: Article 300-5(d) requires the raceway to be at least 8 ft. above finished grade and at least 18" below grade.

If the finished grade changes, or if the raceway is extended above the 8 ft. minimum to 10 ft. or if a manufactured 90 degree elbow is used below grade, this exception could not be used.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1838

6- 106 - (Tables 310-16 through 310-31, Note 8(a), Exception No. 5-(New)): Reject

SUBMITTER: Tom Rea, El Segundo, CA

RECOMMENDATION: Add:

8. (a)

Exception No. 5: Derating factors do not apply for frequencies of 360 hertz and higher.

SUBSTANTIATION: For 400 hertz systems the skin effect increases the effective conductor resistance. This increase in resistance results in increased heating. This frequency will also increase the reactance and with the increased resistance combined will increase the voltage drop which will require additional conductor conductivity and as a result to compensate for these losses these systems conductors are over sized or paralleled over sized so their ampacity are much greater than the loads they are subjected to. It is the general consensus after consulting with many engineers in this field that 400 hertz systems should not be mixed with wires of other systems. Derating factors for 400 hertz wiring should probably be addressed to the I.E.E.E.

Note: Supporting Material Available for Review at NFPA Headquarters.

PANEL ACTION: Reject.

PANEL COMMENT: Supporting data provided by submitter indicates that 400 hertz circuits require greater derating than 60 hertz circuits, which is contrary to this proposal which removes all derating factors for these circuits.

Proposal does not provide any technical information for Panel action.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1407

6- 107 - (Tables 310-16 through 310-31, Note 8(b)): Reject

SUBMITTER: Donald A. Ganiere, Ottawa, IL

RECOMMENDATION: Delete note 8(b).

SUBSTANTIATION: The commentary in the NFPA'S 1987 National Electrical Code Handbook states that the degree of spacing required to install locknuts and bushings at junction boxes is the spacing that is required by this note. In that it is not possible to install conduit closer than this note 8(b) is not needed. If more spacing is required the panel should revise the note to state the required amount of spacing.

PANEL ACTION: Reject.

PANEL COMMENT: Spacing is required for heat dissipation.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3346

6- 108 - (Tables 310-16 through 310-31, Note 8(b)): Reject

SUBMITTER: S. Zackerman, Cincinnati, OH

RECOMMENDATION: Delete this Note.

SUBSTANTIATION: This note is vague, and seemingly not related to anything. The NEC user has no way of knowing what spacings are mandated, nor under what conditions.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-107.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1239

6- 109 - (Tables 310-16 through 310-31, Note 8(b)): Reject

SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I.

RECOMMENDATION: Delete note 8(b) and make it a F.P.N. to 8(a). (Then Note 8(a) reverts to Note 8.)

SUBSTANTIATION: This note takes us back to the days when the Code had some rules that read "shall" and others that read "should". Since there are no indications given as to what spacings are required, this is an unenforceable "rule".

We recognize the importance of the principle involved. But for inspectors, we are not in a position to enforce a principle without a specific rule.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-107.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Sallaz.

EXPLANATION OF VOTE:

SALLEZ: I agree with submitter's substantiation.

Log # 2253

6- 110 - (Tables 310-16 through 310-31, Note 8(c)-(New)): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposals 6-58 and 6-105. This action will be considered by the Panel as a Public Comment.

The Correlating Committee agrees with Durham's comment. In addition the requirement is inappropriate in Note 8 because only derating for the number of conductors in a raceway is covered by the rule.

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add new Note 8(c) as follows:

(c) Underground Raceway Exit Ampacities. Ampacity derating factors shall not be applied to underground conductors entering or leaving an underground direct burial trench or duct bank if such conductors have physical protection in the form of conduit, equipment cubicle, or other similar enclosure and the conductors do not have a length in excess of 10 feet.

SUBSTANTIATION: In the application described above, the underground portion of the circuit acts as a heat sink and dissipates any small amount of extra heating that occurs in the above ground portion of the circuit. Industrial applications have used 15 feet for these conditions for many years without problems.

This note permits terminating underground circuits in switchgear, terminal boxes, metering enclosures, etc. without derating.

PANEL ACTION: Accept in Principle.

Revise the proposal as follows and identify it as a new Note 8(c):

"8(c) Underground Exit Ampacities. Ambient temperature adjustment factors shall not be required for underground conductors entering or leaving an underground direct burial trench or duct bank if such conductors have a length of not more than 15 feet above grade."

PANEL COMMENT: The Panel believes the revised wording more accurately reflects the intent of the proposal, eliminates the restrictions of raceways or enclosures and correlates with changes Panel accepted in Proposal 6-105.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 9

NEGATIVE: Durham.

EXPLANATION OF VOTE:

DURHAM: Proposal is inconsistent with action taken on Proposals 6-58 and 6-105.

COMMENT ON VOTE:

BROWN: I agree with Mr. Durham's negative vote comment. I am not changing my vote because I also agree with the panel's action on this proposal. I feel that we should correlate our actions on proposals 6-58 and 6-105 to agree with our action on this proposal.

Log # 1240

6- 111 - (Tables 310-16 through 310-31, Note 10):

Reject

SUBMITTER: E. Nielsen, M. Shapiro, Michigan Chapter, I.A.E.I.

RECOMMENDATION: In Note 10(a), (b) and (c) replace the word "circuits" with "portions of wiring systems".

SUBSTANTIATION: To assure that Note 10 is understood to apply to branch circuits, feeders, and services. The word "circuit" can be interpreted as applying only to branch circuits. Neither Article 100 nor the IEEE Dictionary clarify the issue when only "circuit" is used.

There are other Articles in the Code in which "circuit" is used where the meaning is the opposite: where "circuit" is obviously meant to cover branch circuits only. But here, the rule can be at least as important for a feeder as for a branch circuit.

PANEL ACTION: Reject.

PANEL COMMENT: It is the Panel's opinion that the generic term "circuit" includes branch circuit, feeders, and services.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2292

6- 112 - (Tables 310-16 thru 310-31, Note 10): Reject

SUBMITTER: Bill Eklund, City of Creston, IA

RECOMMENDATION: Delete note #10(c) of "Notes to Tables 310-16 thru 310-31."

SUBSTANTIATION: We have doubts about the neutral current theory. Using 3 groups of fluorescent fixtures we measured no appreciable current on the neutral with loads balances on a "Y" connected secondary. Do you have test data to sustain the need for counting the neutral conductor as per notes #8 and #10(c)?

PANEL ACTION: Reject.

PANEL COMMENT: Existing theory shows that third harmonic currents can be approximately 25 percent of phase current.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 1573

6- 113 - (Tables 310-16 through 310-31, Note 10(b)):

Reject

SUBMITTER: Chester Flanagan, San Diego, CA

RECOMMENDATION: Amend the second line in Note 10(b) as indicated:

... wire, 3-phase wye-connected system "where all or a major portion of the load is connected line to neutral", a common conductor carries ...

SUBSTANTIATION: This change is needed to expand and clarify the meaning and intent of Note 10(b). For example, the neutral of such a circuit could not be considered to be current-carrying as indicated in Note 10(b) if such circuit supplies line to line and little or no line to neutral load.

PANEL ACTION: Reject.

PANEL COMMENT: The present terminology "a common conductor carries approximately the same current as the other conductors" satisfies the intent.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 11

6- 162 - (Figure 310-1): Reject

Secretary's Note: The following proposal consists of Comment 6-9 on Proposal 6-161 in the 1986 Annual Meeting National Electrical Code Technical Committee Report. This Comment was held for further study during the processing of the 1987 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 6-161 was to change burial depth dimensions as follows:

For concrete encased conduit banks, change 30 inches to 12 inches - 30 inches: (Details Nos. 1-4)

For direct buried cables, change 36 inches to 18 inches - 36 inches. (Details nos. 5-10).

SUBMITTER: H. Brooke Stauffer, National Electrical Manufacturers Association

RECOMMENDATION: Figure 310-1 should be supplemented by a detail illustrating direct burial of metal conduit as covered by Section 300-5.

SUBSTANTIATION: To correlate with Table 300-5.

PANEL ACTION: Reject.

PANEL COMMENT: Note 1 of Figure 310-1 presently covers the subject.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

STRANIERO: Note #1 addresses minimum burial depths in accordance with Section 300-5. The burial depths of Figure 310-1 are now covered by Section 710-3. (See panel action on Proposal 6-49).

Accordingly, reference to Section 300-5 in Note 1 to Figure 310-1 should be changed to "Section 710-3."

Log # 1728

6- 163 - (Figure 310-1): Reject

SUBMITTER: William A. Anderson, Jr., Bellevue, WA

RECOMMENDATION: Delete Figure 310-1 and applicable notes.

SUBSTANTIATION: Considering ambient temperatures of varied installations the derating requirements of Tables 310-25 through 310-27 impose requirements that are not proportional restrictions.

PANEL ACTION: Reject.

PANEL COMMENT: Figure 310-1 has to be retained to preserve the validity of the medium-voltage ampacity table.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: I have voted affirmative on the panel action to reject this proposal. I feel the panel comment should be expanded to read "Fig. 310-1 has to be retained to preserve the validity of the medium voltage ampacity tables (310-77 through 310-84)."

Log # 2248

6- 164 - (Figure 310-1): Accept

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting. This action will be considered by the Panel as a Public Comment.

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Eliminate the words, "maximum Rho = 90" in legend.

SUBSTANTIATION: The 1987 Code limited the value of Rho to 90 to use the tables and Figure 310-1. Actually, Rho can be varied as required by the use of new Figure 310-5 or by calculation. New ampacities added to the underground tables permit this.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.

COMMENT ON VOTE:

COFFEY: I have voted affirmative on the panel action to accept this proposal, however, it should be noted that the proposal to establish Fig. 310-5 (No. 6-71) was initially rejected at the Code Panel Meeting. However, the ampacities for different values of Rho other than 90 can still be calculated.

Log # 2628

6- 165 - (Figure 310-1): Reject

SUBMITTER: Joseph L. Browning, National Electrical Manufacturers Association

RECOMMENDATION: Change all references to "electrical duct" to read "raceway."

SUBSTANTIATION: To correlate with companion proposal to delete definition of "electrical duct" and revert to previous terminology of "raceway."

PANEL ACTION: Reject.

PANEL COMMENT: All electrical ducts are raceways but not all raceways are electrical ducts.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Sallaz, Straniero.

EXPLANATION OF VOTE:

SALLAZ: Same as Proposal 6-50.

STRANIERO: Same as Proposal 6-50.

SUBSTANTIATION: Calculations and field tests indicate that the duct run performs as a large heat sink and thus short deviations in burial depth have an insignificant effect on circuit ampacity.

Neher-McGrath calculations are of such a conservative nature that these deviations can be made without consideration of the length of the deviation so long as it is less than 25% of the circuit length.

PANEL ACTION: Accept in Principle.

In the proposal, delete the word "may" and replace with "shall be permitted to".

Replace "Section 310-15(h) must" with "Note 4 of Tables 310-69 through 310-84 shall".

Delete "Renumbering existing Notes 2 and 3 to become 3 and 4 respectively."

PANEL COMMENT: Change to correlate with NFPA Manual of Style and to correlate with Panel Action on Proposal 6-65.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 3295

6- 166 - (Figure 310-1): Reject

SUBMITTER: Marvin J. Lefkowitz, Acme Electric Company, Inc.

RECOMMENDATION: Eliminate Figure 310-1, revert to 1984 code standard.

SUBSTANTIATION: Configuration of table 310-1 - Detail #4 becomes improbable to achieve based upon the limitation of ampacities imposed by table 310-27.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-163.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2891

6- 167 - (Figure 310-1): Reject

SUBMITTER: Donald W. Zipse, West Chester, PA
RECOMMENDATION: After the term "Rho = 90" add "C° - cm / W", units.

SUBSTANTIATION: Since the CODE uses the term, Rho in Figure 310-1, and since the definition is not readily available, the units for Rho should be included in Figure 310-1.

Definitions of the term "Rho" is not readily available. Neither the Webster's Dictionary nor the ANSI/IEEE Std 100-1984, "IEEE STANDARD DICTIONARY OF ELECTRICAL and ELECTRONICS TERMS" offers a definitions for RHO applicable to "THERMAL RESISTIVITY."

Calls to two university's civil engineering departments when unanswered. A chemical company's technical librarian could not find the term. All by her to an "expert" had the "expert" asking, "What?" Only a call to (Name Deleted) produced the units for the term.

PANEL ACTION: Reject.

PANEL COMMENT: The term Rho has been deleted from Figure 310-1. See Proposal 6-164.

VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2255

6- 168 - (Figure 310-1, Notes for all details): Accept in Principle

Secretary's Note: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the action on Proposal 6-61. This action will be considered by the Panel as a Public Comment.

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add new Note 2 as indicated below. Renumber existing Notes 2 and 3 to become 3 and 4, respectively.

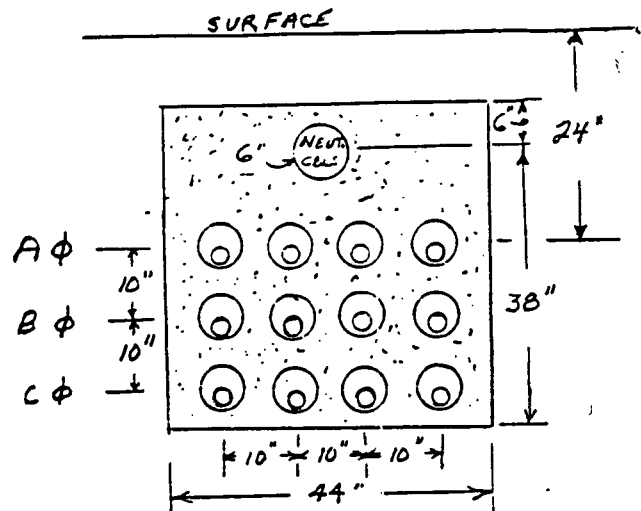
2. Burial depths may be increased in part(s) of the duct run to avoid underground obstructions without decreasing the rated ampacity of the conductors. The total length of parts of the duct run increased in depth to avoid obstructions must be less than 25% of the total run length, or else the ampacity reduction factor of Section 310-15(h) must be applied.

Log # 2243

6- 169 - (Figure 310-2-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add Figure 310-2:



DESIGN CRITERIA

LOAD FACTOR = 100%
NEUTRAL DUCT = 6" PVC
PHASE DUCTS = 3" PVC (MIN)
Rho CONCRETE = 55
Rho EARTH = 60
Rho PVC DUCT = 650
Rho CABLE INSUL = 500
AMBIENT EARTH = 20°C
Rho CABLE JACKET = 650

Phase and neutral conductors are copper, types RHW, THW, THWN, XHHW, or USE.
Conductor temperature = 75°C

Total Per Phase Ampere Rating	Copper 1/c Cable Size	Total Conductor Temperature	Amperes At Rho = 60 LF = 50	Rho = 120 LF = 100
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3000 Ampere Rating (750A/Cable)	1750 MCM	75°C	4000	2456
2500 Ampere Rating (625A/Cable)	1000 MCM	75°C	3676	2298
2000 Ampere Rating (500A/Cable)	700 MCM	75°C	2581	1659

NOTE: Where parallel duct banks are utilized, a separation of 5 feet between the center lines of the closest ducts in each bank, or 4 feet between the extremities of the concrete envelopes is sufficient to prevent derating of the conductors due to mutual heating.

Ambient Temp. °C For ambient temperatures other than 20°C(68°F) multiply the ampacities shown by the appropriate factor shown below. Ambient Temp °F

6-10	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	79-86

Figure 310-2 Cable installation Dimensions for 2000, 2500, and 3000 Ampere Duct Banks, Four Single Conductor Cables Per Phase, Rated 0 through 2000 Volts, in Nonmagnetic Underground Electrical Ducts (One Conductor Per Electrical Duct).

SUBSTANTIATION: This Figure provides ampacities for high ampacity duct banks where it is required, or desired, to limit the number of conductors per phase. Ampacities are included for Rho = 60, LF = 50 and Rho = 120, LF = 100 so that the ampacity of the banks for any normal range of Rho and LF can be determined without calculation by the use of Figure 310-5.

PANEL ACTION: Reject.

PANEL COMMENT: The Panel believes that the table is unnecessary in view of Panel Action on Proposal 6-49.

The ampacities in this table can be generated by the Neher-McGrath computation permitted by Section 310-15.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: This proposal is necessary to add high ampacity duct banks having no more than four ducts per phase to the Code.

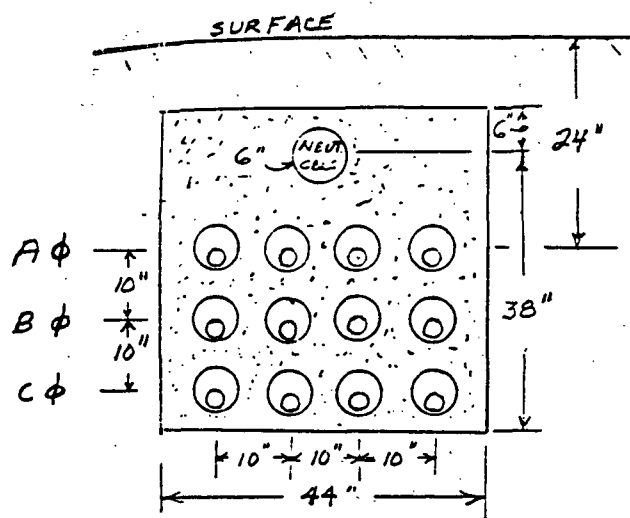
MCCLUNG: Same as Proposal 6-142.

Log # 2532

6- 170 - (Figures 310-2 and 310-3-(New)): Reject

SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association

RECOMMENDATION: Add the new Figures 310-2 and 310-3.



DESIGN CRITERIA

LOAD FACTOR = 100%
NEUTRAL DUCT = 6" PVC
PHASE DUCTS = 3" PVC (MIN)
Rho CONCRETE = 55
Rho EARTH = 60
Rho PVC DUCT = 650
Rho CABLE INSUL = 500
AMBIENT EARTH = 20°C
Rho CABLE JACKET = 650

Phase and neutral conductors are copper, types RHW, THW, THWN, XHHW, or USE.
Conductor temperature = 75°C

Total Per Phase Ampere Rating	Copper 1/c Cable Size	Total Conductor Temperature
3000 Ampere Rating (750A/Cable)	1750 MCM	75°C
2500 Ampere Rating (625A/Cable)	1000 MCM	75°C
2000 Ampere Rating (500A/Cable)	700 MCM	75°C

NOTE: Where parallel duct banks are utilized, a separation of 5 feet between the center lines of the closest ducts in each bank, or 4 feet between the extremities of the concrete envelopes is sufficient to prevent derating of the conductors due to mutual heating.

Ambient Temp. °C For ambient temperatures other than 20°C(68°F) multiply the ampacities shown by the appropriate factor shown below. Ambient Temp °F

6-10	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	79-86

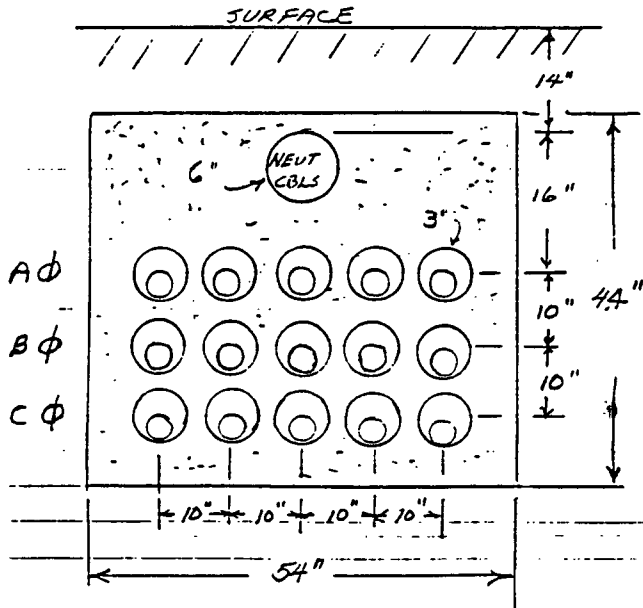
Figure 310-2 Cable installation Dimensions for 2000, 2500, and 3000 Ampere Duct Banks, Four Single Conductor Cables Per Phase, Rated 0 through 2000 Volts, in Nonmagnetic Underground Electrical Ducts (One Conductor Per Electrical Duct).

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.
 FRASURE AND SEGALL: The intent of this proposal is what is needed in the Code, but more complete versions of the same material exist in Proposals 7-171 and 6-172. Ballot should be Approved in Principle.
 MCCLUNG: Same as Proposal 6-142.

Log # 2244

6-171 - (Figure 310-3-(New)): Reject
 SUBMITTER: J. W. Frasure, Houston, TX
 RECOMMENDATION: Add Figure 310-3:



DESIGN CRITERIA

LOAD FACTOR = 100%
 NEUTRAL DUCT = 6" PVC
 PHASE DUCTS = 3" PVC (MIN)
 Rho CONCRETE = 55
 Rho EARTH = 60
 Rho PVC DUCT = 650
 Rho CABLE INSUL = 500
 AMBIENT EARTH = 20°C
 Rho CABLE JACKET = 650

Phase and neutral conductors are copper, types RHW, THW, THWN, XHHW, or USE, 2000 MCM.
 Conductor temperature = 75°C

Ambient Temp. °C	For ambient temperatures other than 20°C(68°F) multiply the ampacities shown by the appropriate factor shown below.					Ambient Temp °F
6-10	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	79-86

Figure 310-3 Cable Installation Dimensions for 4000 Ampere Duct Bank, Five Single Conductor Cables Per Phase, Rated 0 through 2000 Volts, in Nonmagnetic Underground Electrical Ducts (One Conductor Per Electrical Duct)

SUBSTANTIATION: Existing tables in the NEC do not reference duct bank ampacities in excess of 1800-2000 amperes.

Apparently there are enough large ampacity duct bank requirements that users have requested these configurations for ready reference.

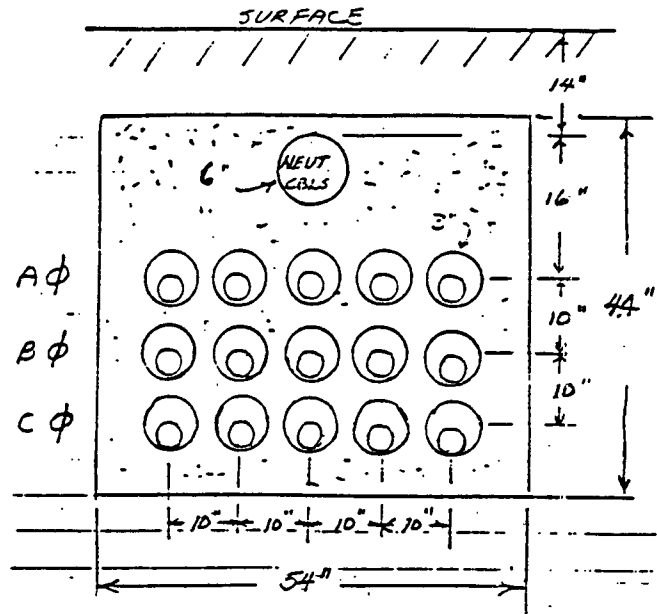
PANEL ACTION: Reject.

PANEL COMMENT: Table lacks the factors necessary to vary Rho and load factors without calculations.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.



DESIGN CRITERIA

LOAD FACTOR = 100%
 NEUTRAL DUCT = 6" PVC
 PHASE DUCTS = 3" PVC (MIN)
 Rho CONCRETE = 55
 Rho EARTH = 60
 Rho PVC DUCT = 650
 Rho CABLE INSUL = 500
 AMBIENT EARTH = 20°C
 Rho CABLE JACKET = 650

Phase and neutral conductors are copper, types RHW, THW, THWN, XHHW, or USE, 2000 MCM.
 Conductor temperature = 75°C

Ampacity at Rho = 60, LF = 50 is 5405 Amperes
 Ampacity at Rho = 60, LF = 100 is 4000 Amperes
 Ampacity at Rho = 120, LF = 100 is 3243 Amperes

Ambient Temp. °C	For ambient temperatures other than 20°C(68°F) multiply the ampacities shown by the appropriate factor shown below.					Ambient Temp °F
6-10	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	79-86

Figure 310-3 Cable Installation Dimensions for 4000 Ampere Duct Bank, Five Single Conductor Cables Per Phase, Rated 0 through 2000 Volts, in Nonmagnetic Underground Electrical Ducts (One Conductor Per Electrical Duct)

Submitted material has been reproduced as received.
 See note on Page 1.

SUBSTANTIATION: This Figure provides the ampacity for a nominal 4000 ampere duct bank where it is required, or desired, to limit the number of conductors per phase.

Ampacities are included for Rho = 60, LF = 50 and Rho = 120, LF = 100 so that the ampacity of the bank for any normal range of Rho and LF can be determined without calculation by the use of Figure 310-5.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-169.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

FRASURE AND SEGALL: This Figure is useful for underground duct bank designs rated between 3243 and 5405 amperes, or 4000 amperes at 100% load factor. It is needed for some very large installations.

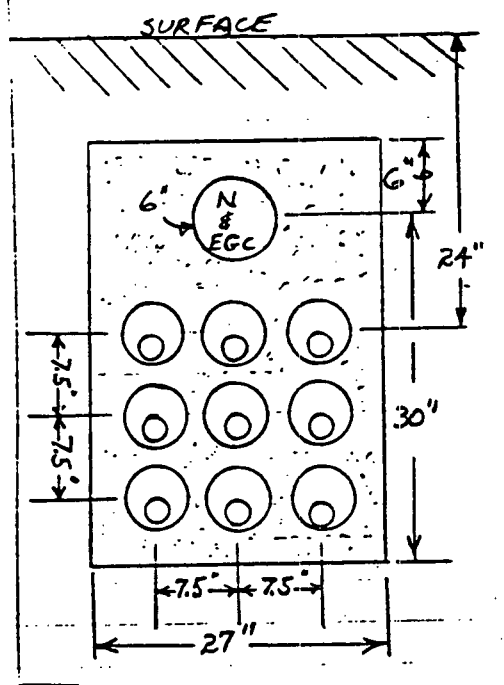
MCCLUNG: Same as Proposal 6-142.

Log # 2245

6- 172 - (Figure 310-4-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add new Figure 310-4:



DESIGN CRITERIA

LOAD FACTOR = 100%
NEUTRAL & DUCT = 6" EGC
PHASE DUCTS = 3-5"
Rho CONCRETE = 85
Rho EARTH = 90
Rho PVC DUCT = 650
Rho CABLE INSUL = 500
AMBIENT EARTH = 20°C
Rho CABLE JACKET = 650

Phase and neutral conductors are copper, types RHW, THW, THWN, XHHW, or USE.

Conductor temperature = 75°C

All ducts must be non-magnetic if phasing is A, B, C in rows or columns. Magnetic ducts are permitted for A, B, C per duct.

Total Per Phase Ampere Rating	Copper 1/c Cable Size	Total Conductor Temperature	Amperes At Rho = 60 LF = 50	Amperes At Rho = 120 LF = 100
1530 Ampere Rating (170A/Cable)	250 MCM	75°C	257	155
1800 Ampere Rating (200A/Cable)	350 MCM	75°C	310	184
2160 Ampere Rating (240A/Cable)	500 MCM	75°C	375	219
Ambient Temp. °C	For ambient temperatures other than 20°C(68°F) multiply the ampacities shown by the appropriate factor shown below.			Ambient Temp °F

6-10	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	79-86

Figure 310-4 Cable Installation Dimensions, High Ampacity Duct Banks, Nine Single Conduit Cables per Phase, Rated 0-2000 Volts, in Underground Electrical Ducts (Three Conductors Per Duct)

SUBSTANTIATION: At the suggestion of users, two tables have been created for high ampacity duct banks that use a maximum wire size of 500 MCM, 75°C, single conductor, since this is the largest size that is usually available without special order. This is one of the tables using three conductors per duct. A companion submission, Figure 310-6, uses the same wire size and one conductor per duct for increased ampacity. Note, that by varying Rho to 60 and LF to 50, typical commercial numbers, the ampacity can be increased approximately 50%.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-169.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: See my comments on Proposal 6-017.

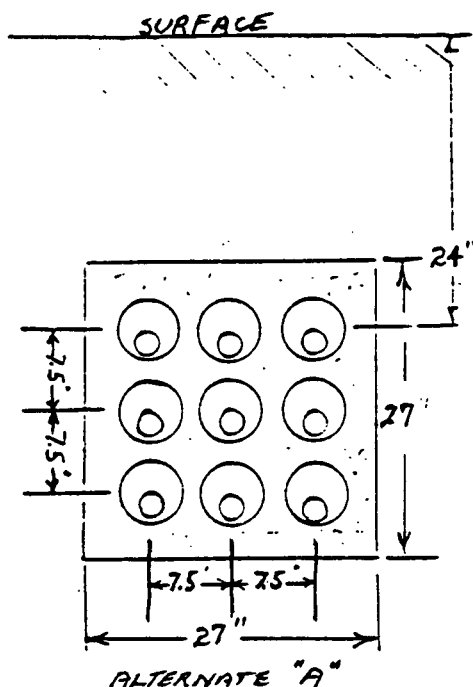
FRASURE: This Figure is needed for high ampacity duct banks where space permits only nine ducts and cable sizes are readily available only up to 500 MCM, copper. The Figure is extremely useful. It assumes a 480/277 volt installation.

Between the limits of Rho = 60, LF = 50 and Rho = 120, LF = 100, the Table shows ampacity variations of 1395 to 3375 amperes per phase using proposed Figure 310-5, Proposal 6-71.

Much discussion has evolved around the configuration shown in the Figure. The original proposal assumed a conductor configuration XXX, XXX, XXX, YYY, YYY, YYY, ZZZ, ZZZ, ZZZ with neutral and equipment grounding conductors in accordance with Article 300-5(i), Exception No. 2. However, some users may wish to configure the installation XYZ per duct with neutral and equipment grounding conductors in each duct. In this case, the top 6 inch duct can be eliminated. The bank would then look like Alternate A, attached.

Many large 600 and 480 volt systems now are high impedance grounded with ground fault current limited to 2-5 amperes by resistor. If the resistor is at the source transformer, no neutral conductor appears in the bank. At most, one neutral conductor would be required.

An error exists in the title, the second line should say, "Nine Single Conductor Cables per Phase".



MCCLUNG: Same as Proposal 6-142.

SEGALL: This Figure is needed where space permits only nine ducts and cable sizes are readily available only up to 500 MCM, copper.

The sketch is modified over the original submittal to show one neutral cable and one equipment grounding cable per duct.

Log # 2246

6- 17 - (Figure 310-6-(New)): Reject

SUBMITTER: J. W. Frasure, Houston, TX

RECOMMENDATION: Add new Figure 310-6

(Figure 310-6 shown on following page.)

SUBSTANTIATION: At the suggestion of users, two tables have been created for high ampacity duct banks that use a maximum wire size of 500 MCM, 75°C, single conductor, since this is the largest size that is usually available without special order. This is one of the tables using a single conductor per duct. A companion submission, Figure 310-4, uses the same wire size and three conductors per duct.

Note, that by varying Rho to 60 and LF to 50, typical commercial numbers, the ampacity can be increased over 40%.

PANEL ACTION: Reject.

PANEL COMMENT: See Panel Comment on Proposal 6-169.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 6

NEGATIVE: Brown, Frasure, McClung, Segall.

EXPLANATION OF VOTE:

BROWN: I feel that the panel should have accepted this proposal. It is one of a group that will provide additional tables to cover more of the typical "underground installations," especially high amperage services. A similar table should be generated for aluminum or copper-clad aluminum conductors. See additional comments on Proposal 6-049.

FRASURE AND SEGALL: This proposal was submitted in response to several requests from the field. Neutral configuration is in accord with 300-5(i); Exception No. 2. When used in conjunction with proposed Figure 300-5, it permits design ampacity variations from 1844 amperes to 4225 amperes using 500 MCM Code conductors. It is not as space efficient as some of the other proposed tables, but is useful when time does not allow for the purchase of larger conductors. This is one of four critical submittals that permits knowledgeable design of high ampacity underground duct banks.

MCCLUNG: This proposal was made to satisfy requests of users. It is technically correct and should be included in future editions of the NEC.

Log # 2940

6- 173 - (Table 310-61): Accept in Principle

SUBMITTER: L. Bruce McClung, Union Carbide Corporation

RECOMMENDATION: Modify Table 310-61 as follows:

In the column entitled Type Letter add an asterisk (*) after MV-75, MV-85, and MV-90. Place a footnote at the bottom of table marked with an asterisk (*) to read:

"* Insulations and outer coverings that meet the requirements of Article 341 and are so listed can be designated Reduced Emissions with the suffix /RE marked with the Type Letters, i.e., MV-90/RE certifies that MV-90 has reduced emissions and that it can be used in occupancies as covered in Articles 517, 518, 520, 530, 620, 645, and 685."

SUBSTANTIATION: Same as Proposal 6-43.

PANEL ACTION: Accept in Principle.

Revise the proposal to read as follows:

"Insulation and outer coverings shall be permitted to be designated limited smoke with the suffix LS.

Example MV-90/LS identifies that this conductor is MV-90 with limited smoke characteristics."

PANEL COMMENT: The Panel believes the Panel's wording satisfies the submitter's request.

VOTE ON PANEL ACTION:

AFFIRMATIVE: 8

NEGATIVE: Straniero.

NOT VOTING: Durham.

EXPLANATION OF VOTE:

STRANIERO: The substantiation submitted with this proposal is inadequate for adding new wire types in the code. No independent laboratory test report has been submitted to support what constitutes limited smoke or what tradeoffs, if any, (as noted in the substantiation for this proposal) are acceptable.

A technical report, i.e., UL fact finding report, that addresses these issues must be submitted to the code panel for review and evaluations.

DURHAM: The Aluminum Association could not reach a consensus opinion on this proposal.

COMMENT ON VOTE:

COFFEY: I have voted affirmative the panel action to accept in principle this proposal, but I feel the wording of the first line of the panel action should be revised in the first line to say "revise the proposal so that the footnote reads as follows: "This is necessary because it was not the Code Panel's intent not to place the asterisk (*) adjacent to the wire types mentioned in the submitter's recommendation."

Log # 2006

6- 174 - (Table 310-62): Accept

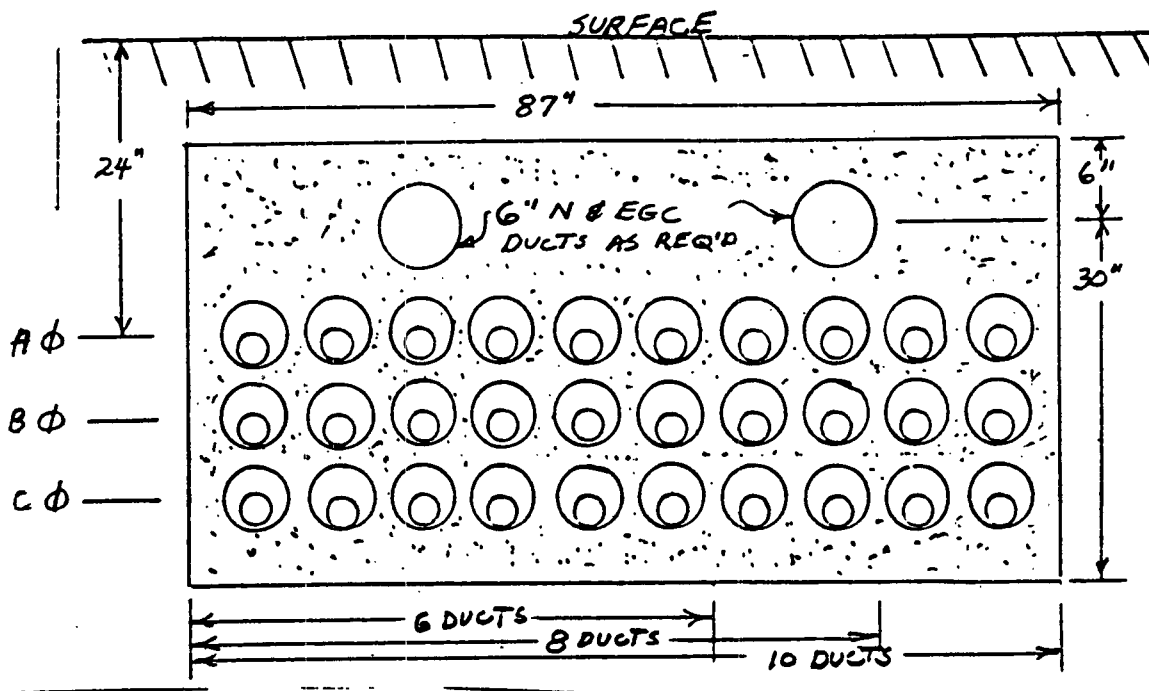
SUBMITTER: James M. Daly, The Okonite Company

RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.

SUBSTANTIATION: Same as Proposal 6-39.

PANEL ACTION: Accept.

VOTE ON PANEL ACTION: Unanimously Affirmative.



All ducts are 7.5" on center horizontally and vertically

DESIGN Load Factor = 100% Rho Values are:
 CRITERIA Phase Ducts are 3 to 5" Earth = 90, Concrete = 85, Ducts = 650
 Earth Ambient = 20°C Cable Insulation = 500, Jacket = 650

Conductors are 500 MCM copper, one per duct, types THW, THWN, XHHW, RHW, or USE.
 Conductor Temperature = 75°C

TOTAL PER PHASE AMPERE RATING	No. of Ducts Per Phase	Amperes Per Phase at	
		Rho = 60, LF = 50	Rho = 120, LF = 100
2000 A (333A/cable)	6	2837	1844
2500 A (313A/cable)	8	3546	2305
3000 A (300A/cable)	10	4225	2746

Ambient Temp. °C	For ambient temperatures other than 20°C (68°F) multiply the ampacities shown by the appropriate factor shown below.					Ambient Temp. °F
6-10	1.09	1.09	1.09	1.09	1.09	43-50
11-15	1.04	1.04	1.04	1.04	1.04	52-59
16-20	1.00	1.00	1.00	1.00	1.00	61-68
21-25	.95	.95	.95	.95	.95	70-77
26-30	.90	.90	.90	.90	.90	79-86

Figure 310-6. Cable Installation Dimensions, Single 500 MCM Copper Conductors Per Duct, Rated 0-2000 Volts, in Underground Electrical Ducts

Log # 2015

6- 175 - (Table 310-63): Accept
 SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 184 - (Table 310-72): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2050

6- 176 - (Table 310-64): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 185 - (Table 310-73): Accept
 SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2016

6- 177 - (Table 310-65): Accept
 SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 186 - (Table 310-74): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2017

6- 178 - (Table 310-66): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 187 - (Table 310-75): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2018

6- 179 - (Table 310-67): Accept.
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 188 - (Table 310-76): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2019

6- 179A - (Table 310-69): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 189 - (Table 310-77): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2020

6- 182 - (Table 310-70): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 190 - (Table 310-78): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2021

6- 183 - (Table 310-71): Accept.
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

6- 191 - (Table 310-79): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Submitted material has been reproduced as received.
See note on Page 1.

Log # 2022
6- 192 - (Table 310-80): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2023
6- 193 - (Table 310-81): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2024
6- 194 - (Table 310-82): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2025
6- 195 - (Table 310-83): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2026
6- 196 - (Table 310-84): Accept
SUBMITTER: James M. Daly, The Okonite Company
RECOMMENDATION: Change "MCM" to "kcmil" in the Table heading.
SUBSTANTIATION: Same as Proposal 6-39.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 116
6- 180 - (Tables 310-69 through 310-84, Note 3): Accept
SUBMITTER: Chester Flanagan, San Diego, CA
RECOMMENDATION: Amend the second line in the second sentence as indicated:
... electrical duct bank (will have to) "shall" be
...
SUBSTANTIATION: This change is required to conform to the 1984 NEC Style Manual, Part A, A-1a.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

Log # 2538
6- 181 - (Tables 310-69 through 310-84, Note 3): Accept
SUBMITTER: Geraldine V. Cox, Chemical Manufacturers Association
RECOMMENDATION: In paragraph 3, change "Tables 310-77, 310-78, 310-79 and 310-84" to "Tables 310-77, 310-78, 310-79, and 310-80."
SUBSTANTIATION: Correct typographical error.
PANEL ACTION: Accept.
VOTE ON PANEL ACTION: Unanimously Affirmative.

ARTICLE XXX -- NEW
ENVIRONMENTAL AIRSPACE NONMETALLIC
WIRING SYSTEM

Log # 3184
8- 1 - (Article XXX-Environmental Airspace Nonmetallic Wiring System-(New)): Reject
Secretary's Note: It was the action of the Correlating Committee that this proposal be referred to CMP 3 for information.
SUBMITTER: Ronald R. Bishop, The Carlon Company
RECOMMENDATION: New text:
Article XXX - Environmental Airspace Nonmetallic Wiring System.

A. General
XXX-1. Definition. Environmental airspace nonmetallic wiring system is a combination of a pliable, coilable corrugated nonmetallic raceway of circular cross section and conductors. The combined system shall have fire-resistant and smoke-producing characteristics that are equivalent to any of the raceways with conductors included in Section 300-22(c). (FPN): One method for determining the equivalency of fire-resistant and smoke producing characteristics is UL Subject Number 1844.

B. Tubing
XXX-1. Definition. Environmental airspace nonmetallic tubing is a pliable, coilable corrugated nonmetallic raceway of circular cross section which is listed for the installation of conductors with integral or associated couplings, connectors and fittings.
A pliable raceway is a raceway which can be bent by hand with a reasonable force but without other assistance.

A coilable raceway is a raceway which may be coiled for packaging and shipping purposes and then uncoiled for installation as a wiring method without adversely affecting the physical properties of the raceway.

XXX-2. Other Articles. Where equipment grounding is required by Article 250, a separate equipment grounding conductor shall be installed in the raceway.

XXX-3. Use Permitted. The use of environmental airspace nonmetallic tubing shall be permitted:

1. When installed as a listed system in other space used for environmental air, such as above suspended ceilings. [Section 300-22(c)].

2. Concealed in walls, floors and ceilings.

3. For low voltage systems.

4. Embedded in poured concrete provided fittings identified for the purpose are used.

XXX-4. Uses Not Permitted. Environmental airspace nonmetallic tubing shall not be used:

1. In hazardous (classified) locations.

2. For the support of fixtures or other equipment.

3. Where subject to physical damage.

4. For direct earth burial.

5. For medium- and high-voltage systems.

6. In exposed applications, except above suspended ceilings.

7. Where subject to ambient temperatures exceeding those for which the tubing is listed.

8. For conductors whose insulation temperature limitations would exceed those for which the tubing is listed.

C. Installation.

XXX-5. Size.

(a) Minimum. Tubing smaller than 1/2-inch electrical trade size shall not be used.

(b) Maximum. Tubing larger than 1-inch electrical trade size shall not be used.

XXX-6. Number of Conductors in Tubing. The number of conductors in a single tubing shall not exceed that permitted by the percentage fill in Table 1, Chapter 9.

XXX-7. Reaming. All cut ends of tubing shall be reamed or otherwise finished to remove rough edges.

XXX-8. Joints. All joints between lengths of tubing and between tubing and couplings, fittings and boxes shall be an approved method.

XXX-9. Bends - How Made. Bends in the tubing shall be so made that the tubing will not be injured and the internal diameter of the tubing will not be effectively reduced. Bends shall be permitted to be made manually without auxiliary equipment and the radius of the curve of the inner edge of such bends shall not be less than shown in Table 346-10.