ARTICLE XXX - Liquidtight Flexible Nonmetallic Conduit

XXX-1. Scope. This article covers use and installation requirements for liquidtight flexible nonmetallic conduit for use in the application of UL and would be required to meet the levels of safety now required for other metallic and nonmetallic raceways before being eligible for UL or equivalent listing and for use where the inspection under the NEC was required.

300-9 of NFPA No. 79 Electrical Standard for Metalworking Machine Tools covers liquidtight flexible nonmetallic conduit and fittings.

E13.3.2 of EMP and EGP-1-1967 Joint Industrial Council Electrical Standard covers Nonmetallic Conduit. Attached is literature on this material:

(a) Anaconda Standard for Liquidtight Flexible Nonmetallic Electrical Conduit; Latest revision 6/12/78.
(b) Anaconda Bulletin 5-550 (BED), pages 33 and 57.

Attachments have been supplied to EMP members.

PANEL RECOMMENDATION: Accept as Revised:

ARTICLE 351 -- LIQUIDTIGHT FLEXIBLE METAL CONDUIT

351-7: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 137 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "Findings" under the definition of "Approved for the Purpose" in Article 100.

Panel 8 comment to Proposal No. 160, for the 1978 Code, "Product not considered suitable for damp locations," is offered as justification for the above proposal.

Panel 8 comment to Proposal No. 160, for the 1978 Code, "Product not considered suitable for damp locations," is offered as justification for the above proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

351-9, Exception: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 139 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "Findings" under the definition of "Approved for the Purpose" in Article 100.

Panel 8 comment to Proposal No. 160, for the 1978 Code, "Product not considered suitable for damp locations," is offered as justification for the above proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
conduit, it shall be contained in the conduit with the circuit conductors. Fittings and boxes shall be bonded or grounded in accordance with Article 250.

SUBSTANTIATION: There is a very pressing need for an NEC Article to cover liquidtight flexible nonmetallic conduit for a growing number of present day applications. Such a product is being produced and has been used extensively in the machine tool industry and other related uses for the past eleven years. At the present time there is no NEC reference for this material.

It may be agreed that the need for this article is such that it might be adopted based on the known, widespread and successful use in industry of liquidtight flexible nonmetallic conduit. Once in the NEC, such a product would immediately come under the scrutiny of UL and would be required to meet the levels of safety now required for other metallic and nonmetallic raceways before being eligible for UL or equivalent listing and for use wherever an inspection under the NEC was required.


XXX-2. Definition. Liquidtight flexible nonmetallic conduit is a raceway of circular cross section having a smooth seamless inner core and outer bonded together with reinforcement layers between the core and cover. This conduit is flame-resistant and with fittings is approved for the installation of electrical conductors.

XXX-3. Use.
(a) Liquidtight flexible nonmetallic conduit shall be permitted to be used:
(1) in exposed locations;
(2) where flexibility is required for installation, operation or maintenance;
(3) where protection of the contained conductors is required from vapors, liquids or solids.
(b) Liquidtight flexible nonmetallic conduit shall not be used:
(1) where subject to physical damage;
(2) where any combination of ambient and conductor temperatures is in excess of that for which the liquidtight flexible nonmetallic conduit is approved;
(3) in lengths longer than 6 feet;
(4) where voltage of contained conductors is in excess of 600 volts, nominal.

XXX-4. Size. The sizes of liquidtight flexible nonmetallic conduit shall be electrical trade sizes 1/2 inch to 1 1/2 inch inclusive.

XXX-5. Number of Conductors. The number of conductors permitted in a single conduit shall be in accordance with the percentage fill specified in Table 1, Chapter 9.

XXX-6. Fittings. Liquidtight flexible nonmetallic conduit shall be used only with terminal fittings identified for such use.

XXX-7. Grounding. Where a grounding conductor is required for the circuits installed in liquidtight flexible nonmetallic conduit, it shall be contained in the conduit with the circuit conductors. Fittings and boxes shall be bonded or grounded in accordance with Article 250.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COMMENT ON VOTE: We believe the use of this material has been limited for "connection to frequently moving parts" under the provisions of Section 210-5(e) of NFPA Standard No. 79. This possible additional use restriction needs further clarification.

ARTICLE 352 -- SURFACE RACEWAYS

352-1: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 140 Delete words "in concealed work" from the title, and the word "concealed" from the text.

SUBSTANTIATION: No restriction, per se, is placed on the maximum number of bends in exposed work. No limit on number of bends could result in damage to conductors, in a run with excessive number of bends, or could encourage installation of conductors prior to conduit installation, with conduit then installed as a cable system. A limit on number of bends for exposed work would bring this section in conformity with the requirements for other raceway systems, such as 345-12, 346-11, 347-14, and 348-10.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

352-2: Accept
PROPOSAL: 142 Add the word "only" at the end of the first sentence. Add new (1) as follows: (1) in damp locations; unless approved for the purpose. Renumber remainder of paragraph.

SUBSTANTIATION: The present wording is being interpreted as permitting use of surface raceways in damp locations. The addition of the word only in the above proposal clarifies that surface raceways are intended for use in dry locations only, unless approved for use in damp locations.

Panel 8 comment to Proposal No. 160, for the 1978 Code, "Product not considered suitable for damp locations," is offered as justification for the above proposal.

Panel Recommendation: Reject.
Panel Comment: No additional clarification would be achieved by this Proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

352-3: Reject
SUBMITTER: O. E. Dillon, Border County Div. IAEI
PROPOSAL: 143 In the first sentence, add the word "only" after the word "permit." In the second sentence (1), delete the word "severe." In the second sentence (2), add the words "there are" after the word "where."

SUBSTANTIATION: The language is permissive and does not restrict the use of surface raceways. See the attached opinion of the San Diego City Attorney.

*See Border County Div. IAEI substantiation for proposal for 110-16(a).

Panel Recommendation: Reject.
Panel Comment: The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 356 -- CELLULAR METAL FLOOR RACEWAYS

356-6: Accept
SUBMITTER: Charles T. Flachbarth, Walker Parkersburg Division Texton Inc.
PROPOSAL: 152 Add a second sentence as follows:
"For the purposes of this article, a cellular metal floor consists of the entire floor area being covered with cellular metal floor sections or a combination of cellular metal floor raceway sections and corrugated metal deck sections."
SUBSTANTIATION: In some building designs, there is confusion regarding when a cellular metal floor raceway system as described in Article 356 can be used, compared with an underfloor raceway system as described in Article 354. This proposed change will eliminate confusion regarding when Article 356 applies or when Article 354 applies, without changing the intention of the Code regarding the use of cellular metal floor raceways or underfloor raceway systems.

PANEL RECOMMENDATION: Accept.

EXPLANATION OF VOTE:
"BREITING: While Installation instructions are supplied by the manufacturer covering the intended floor construction, this proposal would provide clarification to those who may not have access to these instructions.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 355 -- MULTIOUTLET ASSEMBLY

355-1: Accept
SUBMITTER: R. S. Pinkerton, Los Angeles, CA
PROPOSAL: 154 Change the present Section 356-12 to 356-13 and 356-12(5) to 356-13(5) as follows:
“..."Restrict the use of underfloor raceways. See the attached opinion of the San Diego City Attorney.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 354 -- UNDERFLOOR RACEWAYS

354-2: Reject
SUBMITTER: O. E. Dillon, Border County Div. IAEI
PROPOSAL: 150 In the first sentence, add the word “unless” after the word “permitted.” In the third sentence, delete the word “severe.”

PANEL RECOMMENDATION: The present wording adequately reflects the Panel’s intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 356 -- CELLULAR METAL FLOOR RACEWAYS

356-1: Reject

SUBMITTER: Charles T. Flachbarth, Walker Parkersburg Division
Texton Inc.

PROPOSAL: 152 Add a second sentence as follows:

"For the purposes of this article, a cellular metal floor consists of the entire floor area being covered with cellular metal floor sections or a combination of cellular metal floor raceway system as described in Article 356 can be used, compared with an underwater raceway system as described in Article 354 can be used to eliminate confusion regarding when Article 356 applies or when Article 354 applies, without changing the intention of the Code regarding the use of cellular metal floor raceways or underwater raceway systems.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: No additional clarification would be achieved by this proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

356-11: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 153 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

356-12: Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 154 Change the present Section 356-12 to 356-13 and add a new Section 356-12 (under Part A) as follows:

356-12. Aligning and Sealing. Cellular metal floor raceways shall be so installed that all sections which are used as raceways for conductors are aligned and joined to provide a smooth raceway free of sharp edges or foreign materials. Raceway joints shall be sealed to prevent the entrance of water and concrete mix as soon as possible after the ducts are secured in place.

SUBSTANTIATION: The ends of adjoining sections of cellular metal floor raceways shall be so installed that all sections which are used as raceways for conductors are aligned and joined to provide a smooth raceway free of sharp edges or foreign materials. Raceway joints shall be sealed to prevent the entrance of water and concrete mix as soon as possible after the ducts are secured in place.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
352-1: Exception No. 1: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 144 See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

SUBSTANTIATION: See the TSC “findings” under the definition of “Approved for the Purpose” in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

352-2: Reject

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 145 See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

SUBSTANTIATION: The language is permissive and does not restrict the use of nonmetallic surface raceways. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

352-22: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 152 Add a second sentence as follows: “For the purposes of this article, a cellular metal floor consists of the entire floor area being covered with cellular metal floor sections or a combination of cellular metal floor raceway sections and corrugated metal deck sections.”

SUBSTANTIATION: See the TSC “findings” under the definition of “Approved for the Purpose” in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

352-22-1: Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 153 See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

SUBSTANTIATION: The language is permissive and does not restrict the use of cellular floor raceways. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

354-1: Reject

SUBMITTER: R. M. Pinkerton, Los Angeles, CA

PROPOSAL: 154 Change the present Section 356-12 to 356-13 and 356-12 (under Part A) as follows:

Restrict the use of underfloor raceways. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

354-12-(New): Reject

SUBMITTER: R. M. Pinkerton, Los Angeles, CA

PROPOSAL: 155 See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

SUBSTANTIATION: The language is permissive and does not restrict the use of underfloor raceways. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

356-11: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 156 Add a second sentence as follows: “Where identified for such use.”

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

356-12: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 157 See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

SUBSTANTIATION: The language is permissive and does not restrict the use of underfloor raceways. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
354-2: Reject
SUBMITTER: O. E. Dillon, Border County Div., IAEI
PROPOSAL: 150 In the first sentence, add the word "only" after the word "permitted." In the second sentence, delete the word "severe."
SUBSTANTIATION: The language is permissive and does not restrict the use of underfloor raceways. See the attached opinion of the San Diego City Attorney.

Panel's Intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 356 -- CELLULAR METAL FLOOR RACEWAYS

356-1: Reject
SUBMITTER: Charles T. Flachbarth, Walker Parkersburg Division Textron Inc.
PROPOSAL: 152 Add a second sentence as follows: "For the purposes of this article, a cellular metal floor consists of the entire floor area being covered with cellular metal floor sections or a combination of cellular metal floor raceways and corrugated metal deck sections."

Panel's Intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 354 -- UNDERFLOOR RACEWAYS

354-2: Reject
SUBMITTER: O. E. Dillon, Border County Div., IAEI
PROPOSAL: 150 In the first sentence, add the word "only" after the word "permitted." In the third sentence, delete the word "severe."

Panel’s Intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 354 -- UNDERFLOOR RACEWAYS

354-2: Reject
SUBMITTER: O. E. Dillon, Border County Div., IAEI
PROPOSAL: 150 In the first sentence, add the word "only" after the word "permitted." In the third sentence, delete the word "severe."

Panel's Intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
Accordingly, this has caused problems in enforcement. Also, the joints must be taped or sealed to prevent the entrance of water or concrete which obviously can damage the conductor insulation when branch circuits are installed.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

356-12-(New): Reject

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 155 Change the present Section 356-12 to 356-13 and add a new 356-12 (under part A) to read: 356-12. Aligning and Sealing. Cellular metal floor raceways shall be so installed that all sections which are used as raceways for conductors are aligned and joined to provide a smooth raceway free of sharp edges or foreign materials. Raceway joints shall be sealed to prevent the entrance of water and concrete mix as soon as possible after the ducts are secured in place.

SUBSTANTIATION: The ends of adjoining sections of cellular metal floor raceways must be lined up to prevent insulation damage during the wire pulling process. The design of cellular metal floor does not assure alignment and there are no specific Code requirements for such an alignment. Accordingly, this has caused problems in enforcement. Also, the joints must be taped or sealed to prevent the entrance of water or concrete which obviously can damage the conductor insulation when branch circuits are installed.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 358 -- CELLULAR CONCRETE FLOOR RACEWAYS

358-4: Accept  CMP 8

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 156 Insert the Technical Committee "Recommendations" to the definition of "Approved for the Purpose" in Article 100.3.

PANEL RECOMMENDATION: Accept as Revised:
Delete the words "Approved for the purpose" and add "approved" before the word "listings."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

358-12-(New): Reject  CMP 8

SUBMITTER: S. Pinkerton, Los Angeles, CA

PROPOSAL: 157 Add a new section as follows:
358-12. Aligning and Sealing. Cellular concrete floor raceways shall be so installed that all sections used as raceways for conductors are aligned and joined to provide a smooth raceway free of sharp edges or foreign materials. Raceway joints shall be sealed to prevent the entrance of water or concrete mix as soon as possible after the ducts are secured in place.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
WORKING SPACE. At least 12 inches of working space shall be provided for conductors in a wireway at points not more than 3 feet apart. At least 12 inches of working space shall be provided for conductors in a wireway at points not more than 3 feet apart. At least 12 inches of working space shall be provided for conductors in a wireway at points not more than 3 feet apart.

EXPLANATION OF VOTE:

YOUNG: The Code is not considered to be a design standard but in my opinion to require a product to be properly protected from damage through transit and installation is not a design requirement.

356-12-(New): Reject

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 155 Change the present Section 356-12 to 356-13 and add a new Section 356-12 (under part A) to read:

356-12. Aligning and Sealing. Cellular metal floor raceways shall be so installed that all sections which are used as raceways for conductors are aligned and joined to provide a smooth raceway free of sharp edges or foreign materials.

Raceyway shall be sealed to prevent the entrance of water and concrete mix as soon as possible after the ducts are secured in place.

SUBSTANTIATION: The ends of adjoining sections of cellular metal floor raceways shall be joined to prevent insulation damage during the wire pulling process. The design of cellular metal floor does not assure alignment and there are no specific Code requirements for such an alignment. Accordingly, this has caused problems in enforcement. Also the joints must be taped or sealed to prevent the entrance of water or concrete which obviously can damage the conductor insulation when branch circuits are installed.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

YOUNG: See comments for Proposal No. 154.

356-12-(New): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 157 Add a new section as follows:

356-12. Aligning and Sealing. Cellular concrete floor raceways shall be so installed that all sections used as raceways for conductors are aligned and joined to provide a smooth raceway free of sharp edges or foreign materials. Raceway joints shall be sealed to prevent the entrance of water and concrete mix as soon as possible after the ducts are secured in place.

SUBSTANTIATION: The ends of adjoining sections of cellular concrete raceways are to be lined up to prevent insulation damage during the wire pulling process. The design of cellular concrete floor does not assure alignment and there are no specific Code requirements for such an alignment.

Accordingly, this has caused problems in enforcement. Also the joints must be taped or sealed to prevent the entrance of water or concrete which obviously can damage the conductor insulation when branch circuits are installed.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

358-4: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 158 Change the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100 to read:

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

Delete the words "approved for the purpose" and add "approved" before the word "listings."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

358-12-(New): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 159 Insert after "Intermediate metal conduit." Then add new sentence at end of section to read: "Where rigid nonmetallic conduit is used, connection of equipment grounding conductors in the rigid nonmetallic-conduit to the wireway shall comply with Sections 250-113 and 250-118." This use of rigid nonmetallic conduit is now acceptable under Article 347. The change in Article 362 will bring it into conformity with other parts of the Code.

PANEL RECOMMENDATION: Unanimously Affirmative.

358-11-(New): Reject

SUBMITTER: CMP 8

PROPOSAL: 160 Add a new section as follows:

358-11. Position. Wireways may be installed with the cover face in a downward position provided suitable supports for conductors are installed therein at points not more than 3 feet apart.

SUBSTANTIATION: In the definition of a wireway in Section 362-1 appears the statement "in which conductors are laid in place after the wireway has been installed." This implies and has been interpreted to mean that wireways must be installed with the cover on the side or top for conductors to be laid in place. But in many applications, this is an impracticable position. Where conductors have suitable insulating supports, they can be positioned in a wireway with the cover facing down without danger of damaging the conductor insulation. This provision has been permitted in the City of Los Angeles for many years with no reported failures.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Such practice is not prohibited by present Code.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

362-12-(New): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 161 Add a new section as follows:

362-12. Working Space. At least 12 inches of working space shall be provided between the front of a wireway and walls, ceilings or similar obstructions.

SUBSTANTIATION: The intent of this requirement is to provide a safe work environment for electricians who will be performing maintenance work or making additions to existing wireway...
installations. Maintenance electricians should have sufficient workspace in front of a wireway so that they can look inside and examine the condition of conductor insulation for splice insulation before pulling wires out of a wireway. Experience has shown that conductor insulation does become damaged and the insulation on splices can open up which can present a severe shock hazard to people who reach into the wireway while working "blind". A twelve inch minimum working space is a reasonable and practical dimension and will greatly enhance safe working conditions for maintenance electricians.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by Section 110-16.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 364 -- BUSWAYS

364-2: Accept

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 167 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

364-3: Accept

SUBMITTER: J. J. Kark, National Electrical Manufacturers Assn.

PROPOSAL: 167 Add a sentence as follows: "Flexible cord assembly connections may be made directly to the load end terminals of a busway plug-in device, providing that the connection includes a suitable tension take-up device on the cord."

SUBSTANTIATION: Section 364-8 lists eight types of equipment permitted for connection to busway but contains no guidelines for the make-up of such connections. In the case of cord assembly connections to busway plug-in devices, seekers of guidance may be drawn to 400-7(b). This paragraph is aimed primarily at fixed location connections and requires a receptacle outlet on the power supply plus an attachment plug on the cord.

Minimizes the possibility of unnecessary components being furnished in the connection.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

364-4: Accept

SUBMITTER: David J. Snitzer, City of Los Angeles Code Advisory Committee

PROPOSAL: 169 Add note as follows: "Note: Overcurrent devices on busways shall be installed in accordance with the requirements of Section 380-8.

SUBSTANTIATION: Clarification.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The cross reference is redundant.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 365 -- CABLEBUS

365-1:-(New) Add note as follows:

"Where rigid nonmetallic conduit is used, the cord.

receptacle outlet on the power supply plus an attachment plug on the cord."

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

365-2: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 170 Fine Print Note.

Overcurrent devices on busways shall be installed in accordance with the requirements of Section 380-8.

SUBSTANTIATION: Clarification.

PANEL RECOMMENDATION: Accept.

PANEL COMMENT: Fine Print Note.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

365-3: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 171 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

365-4: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 172 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

157
ARTICLE 363 -- FLAT CABLE ASSEMBLIES

363-1: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 118 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-2: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 118 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-3: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 118 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-4: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 118 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-5: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 120 Revise as follows:
"Switches shall be made in approved junction boxes using approved wiring methods.
SUBSTANTIATION: Use of approved terminal blocks has proved effective in preventing maintenance problems. Many installations have been made where standard approved wiring methods, such as wire nuts, were permitted by the local inspector.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-6: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 121 Revise as follows:
"Taps shall be made between any phase conductor and the neutral or any other phase conductor by means of devices and fittings approved for the purpose. Taps shall be permitted by the local inspector.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-7: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 121 Revise as follows:
"Taps shall be made between any phase conductor and the neutral or any other phase conductor by means of devices and fittings approved for the purpose. Taps shall be permitted by the local inspector.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-8: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 121 Revise as follows:
"Taps shall be made between any phase conductor and the neutral or any other phase conductor by means of devices and fittings approved for the purpose. Taps shall be permitted by the local inspector.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-9: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"Electrical-discharge lampholders of screw-shell type shall be approved for the purpose. Use of approved lampholders and approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-10: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"Electrical-discharge lampholders of screw-shell type shall be approved for the purpose. Use of approved lampholders and approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-11: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"Electrical-discharge lampholders of screw-shell type shall be approved for the purpose. Use of approved lampholders and approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-12: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"Electrical-discharge lampholders of screw-shell type shall be approved for the purpose. Use of approved lampholders and approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-13: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"All extensions from flat cable assemblies shall be made by approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly run.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-14: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"All extensions from flat cable assemblies shall be made by approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly run.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

363-15: Accept
SUBMITTER: S.J. Casasanta, West Hartford, CT
PROPOSAL: 122 Revise as follows:
"All extensions from flat cable assemblies shall be made by approved wiring methods, within the junction boxes, installed at the end of the flat cable assembly run.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 645 -- DATA PROCESSING SYSTEMS

645-1: Accept

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 133 Change the word "electric" to "electronic data processing" in Subparagraph (a);

STAFF: There are certain associated functions carried out in data processing rooms which employ electric typewriters, adding machines, calculators, etc., and this equipment is not part of the data processing system. Under the present Code wording, these appliances must be capable of being disconnected along with the computer equipment. Furthermore, the present phrase "electric equipment in the room" can include fire warning systems and fire suppression systems. It appears from the statements made in NFPA 75 dealing with protection of electronic computers and data processing equipment that the intent is to disconnect the electronic equipment rather than other appliances or systems in the room. The wording of the Code should reflect this intent.

PANEL RECOMMENDATION: Accept as Revised;

REPLACE existing Section 645-3 with the following paragraph:

645-3. Disconnecting Means. A disconnecting means shall be provided to disconnect the power to all electronic equipment in the computer room. This disconnecting means shall be controlled from locations readily accessible to the operator at the principal exit doors. There shall also be a similar disconnecting means to disconnect the air-conditioning system serving this area.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

645-11: Accept

SUBMITTER: R. Bezdegian, Shrewsbury, MA

PROPOSAL: 132 Add "Type AC cable."

STAFF: Type AC cable is suitable for this use and is more readily obtainable than Type MC. It is permitted by Section 300-22(c) above ceilings used for air-handling. Why not under raised floors. It could withstand physical injury, much the same as Type MC, flexible metallic conduit, liquidtight flexible metal conduit, or data processing equipment cables.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 636 -- ELECTRICAL FLOOR ASSEMBLIES

636-5: Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 128 Add "nominal" after "120 volts."

STAFF: The rated voltage and current.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

636-20(b)(1): Reject

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 129 Revise as follows:

"[1]" The rated voltage and current.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 366 -- ELECTRICAL FLOOR ASSEMBLIES

366-18: Accept

SUBMITTER: TSC-Approved for the Purpose

STAFF: The Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised;

DELETE "approved for the purpose" and replace with "identified for the purpose."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

366-20: Accept

SUBMITTER: TSC-Approved for the Purpose

STAFF: The Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised;

DELETE "approved for the purpose" and replace with "identified for the purpose."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
installations. Maintenance electricians should have sufficient
work space in front of a wireway so that they can look inside and
examine the condition of conductor insulation for splice
insulation before pulling wires out of a wireway. Experience
has shown that conductor insulation does become damaged and
the insulation on splices can open up which can present a severe
shock hazard to people who reach into the wireway while working
"blind". A twelve inch minimum working space is a reasonable
and practical dimension and will greatly enhance safe working
conditions for maintenance electricians.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by Section 110-16.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

362-12-(New): Reject

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 162

362-12: Position. Wireways may be installed with the cover
face in a downward position provided suitable supports for
conductors are installed therein at points not more than three
feet apart.

SUBSTANTIATION: In the definition of a wireway in Section 362-1
appears the statement "in which conductors are laid in place
after the wireway has been installed." This implies and has
been interpreted to mean that wireways must be installed with
the cover on the side or top for conductors to be laid in
place. But in many applications, this is an impractical
position, Where conductors are supported with adequate
insulating supports, they can be positioned in a wireway with the cover facing down
without danger of damaging the conductor insulation. This
provision has been permitted in the City of Los Angeles for many
years with no reported failures.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Such practice is not prohibited by present Code.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

362-13-(New): Reject

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 163

362-13: Working Space. At least 12 inches of working space
shall be provided for the cover of a wireway and walls,
ceilings or similar obstructions.

SUBSTANTIATION: The intent of this requirement is to provide a
safe work environment for electricians who will be performing
maintenance work or making additions to existing wireway
installations. Maintenance electricians should have sufficient
work space in front of a wireway that they can look inside and
examine the condition of conductor insulation for splice
insulation before pulling wires out of a wireway. Experience
has shown that conductor's insulation does become damaged and
the insulation on splices can open up which can present a severe
shock hazard to people who reach into the wireway while working
"blind". A twelve inch minimum working space is a reasonable
and practical dimension and will greatly enhance safe working
conditions for maintenance electricians.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by Section 110-16.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 364 -- BUSWAYS

364-4(b): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 164 See the Technical Subcommittee "Recommendations"
under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of
"Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:
"Delete the words "approved for the purpose" and substitute
"identified for such use.""

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

364-5, Exception No. 2: Reject

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 165 See the Technical Subcommittee "Recommendations"
under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of
"Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel Action on Proposal No. 165.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
I Revise 364-5 of the NEC as follows: "Busways shall be securely supported at intervals not exceeding 5 feet unless identified for such use."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PANEL COMMENT: The cross reference is redundant.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

364-8, FPN-(New): Reject

CMO 8

SUBMITTER: H. F. van der Voort, Cleveland, Ohio

PROPOSAL: 160 Add a note as follows: "Flexible cord assembly connections may be made directly to the load end terminals of a busway plug-in device, provided the connection includes a suitable tension take-up device on the cord."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PANEL COMMENT: See Panel action on Proposal No. 165.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 365 -- CABLEBUS

365-2: Accept

CMO 8

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 172 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

365-8: Accept

CMO 8

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 177 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 374 -- AUXILIARY GUTTERS

PROPOSAL: 172* Add new (f) as follows: "Where an auxiliary gutter is to contain bends or taps to an electric supply's service conductors larger than No. 1 AWG, its width at the cover shall be at least 200 percent of that given in Table 373-6(a) and its minimum depth from cover to back shall be 100 percent of the width given in Table 373-6(a)."

Where the size of the service conductor is not readily available, the conductor size may be calculated as the equivalent size of the largest aluminum conductors with a 275°C ampacity rating equal to the sum of the service overcurrent devices taped to the supplier's service conductors. In the table, "Wires per terminal" is to be used to indicate the number of the supply service conductors in parallel per phase.

PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 9 -- TABLES AND EXAMPLES

Chapter 9, Table 1, Note 5: Accept

PROPOSAL 8 Add to Note 5 the word "maximum" before "allowable." Add FPN after Note 5 to read:

Table 1 is based on common conditions of proper cabling and alignment of conductors where the length of the pull and the number of bends are within reasonable limits. It should be recognized that for unusual conditions a larger size conduit or lesser conduit fill should be considered.

PANEL RECOMMENDATION: Clarification.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PROPOSAL: 175A* In the 3 conductor column, delete 40 (percent fill) and insert 33 (percent fill) for both lead covered and non-lead covered conductors.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PROPOSAL: 175B* In the 3 conductor column, delete 40 (percent fill) and insert 33 (percent fill) for both lead covered and non-lead covered conductors.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Chapter 9, Table 1, Note 6: Reject

PROPOSAL: 176* I suggest that the number of wires that is attached in 1/2 inch and 3/4 inch pipe be reduced to half. The wire I'm talking about is TW, THHN, THWN, sizes #12, #14, and #10. As an alternate, they would change the 40 percent fill to 60 percent fill based on individual diameters.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PROPOSAL: 175C* In the 3 conductor column, delete 40 (percent fill) and insert 33 (percent fill) for both lead covered and non-lead covered conductors.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 366 -- ELECTRICAL FLOOR ASSEMBLIES

366-1: Accept

SUBMITTER: Approved for the Purpose

PROPOSAL: 126 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

STUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised: Delete "approved for the purpose" and replace with "identified for the use."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

366-20(b)(1): Reject

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 129 Revise as follows: (1) The rated voltage and current.

STUBSTANTIATION: Change recommended for clarification and to obtain conformance with present practice and uniformity within the Code.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 645 -- DATA PROCESSING SYSTEMS

645-1: Accept

Secretary's Note: It was the action of the Correlating Committee that the Panel clarify the Panel Recommendation with regard to original Proposal.

SUBMITTER: N. K. Glenn, Pacific Coast Electrical Assn.

PROPOSAL: 130 Delete the word "including" and replace with the word "other than.

STUBSTANTIATION: There are misinterpretations of this section. It is unrealistic and we do not believe it was the intent of the Panel to include in the requirements under Section 645-1 the remote telephone terminal units and cash registers in supermarkets and other similar small terminals.

PANEL RECOMMENDATION: Accept as Revised:

"AD" the words "In a data processing room" at the end of Section 645-1.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

645-2(c)(2): Accept

SUBMITTER: R. Bezdegian, Shrewsbury, MA

STUBSTANTIATION: Type AC cable is suitable for this use and is more readily obtainable than Type MC. It is permitted by Section 300-22(c) above ceilings used for air-handling. Why not under raised floors. It could withstand physical injury, much the same as Type MC, flexible metal conduit, liquidtight flexible metal conduit, or data processing equipment cables.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

EXPLANATION OF VOTE:

SAPPINGTON: I do not feel sufficient supporting comment has been submitted. I feel there is a real question related to terminations and mechanical execution, therefore, in order to minimize potential fires resulting from same, said proposal should not be accepted.

BOWEN: I am voting negative. I do not feel that under raised floors is as acceptable as above ceilings. Also the termination difference.

HART: I do not believe that there is sufficient supporting comment to accept this Proposal. Even though there are some similarities between Type AC cable and Type MC cable, there is a considerable difference in the terminations. I see no need to have AC cable in this section.

645-3: Accept

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 133 Change the word "electric" to "electronic data processing" in Subparagraph (a).

STUBSTANTIATION: There are certain associated functions carried out in data processing rooms which employ electric typewriters, adding machines, calculators, etc., and this equipment is not part of the data processing system. Under this present Code wording, these appliances must be capable of being disconnected along with the computer equipment. Furthermore, the present phrase "electric equipment in the room" can include fire warning systems and fire suppression systems. It appears from the statements made in NFPA 75 dealing with protection of electronic computers and data processing equipment that the intent is to disconnect the electronic equipment rather than other appliances or systems in the room. The wording of the Code should reflect this intent.

PANEL RECOMMENDATION: Accept as Revised:

"Replace existing Section 645-3 with the following paragraph:

645-3. Disconnecting Means. A disconnecting means shall be provided to disconnect the power to all electronic equipment in the computer room. This disconnecting means shall be controlled from locations readily accessible to the operator at the principal exit doors. There shall also be a similar disconnecting means to disconnect the air-conditioning system serving this area.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

645-3(a): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 134 Delete the word "electric" and replace with the word "electronic, "

STUBSTANTIATION: There are certain associated functions carried out in data processing rooms which employ electric typewriters, adding machines, calculators, etc., and this equipment is part of the data processing system. Under this present Code wording, these appliances must be capable of being disconnected along with the computer equipment. Furthermore, the present phrase "electric equipment in the room" can include fire warning systems and fire suppression systems. It appears from the statements made in NFPA 75 dealing with protection of electronic computers and data processing equipment that the intent is to
ARTICLE 370 -- OUTLET, SWITCH AND JUNCTION BOXES, AND FITTINGS

370-3: Reject

SUBMITTER: R. W. Eckhardt, Underwriters Laboratories Inc.

PROPOSAL: 3. Revise as follows:

370-3 Nonmetallic Boxes. Nonmetallic boxes shall be permitted only with open wiring on insulators, concealed knob and tube wiring, nonmetallic-sheathed cable and with rigid nonmetallic conduit.

Exception: Nonmetallic boxes over 100 cubic inches manufactured with bonding means between all raceway and cable entries shall be permitted to be used with metal raceways and metal-sheathed cable.

SUBSTANTIATION: The wording adopted for the 1978 Code inadvertently omitted covering nonmetallic boxes over 100 cu. in. with rigid, nonmetallic conduit. This error can be corrected by omitting the phrase "not over 100 cu. in." in the first sentence and making the second sentence an "Exception."

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 3.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-3: Accept

SUBMITTER: R. C. Medley, Square D Co.

PROPOSAL: 2. In the first paragraph, delete the words "not over 100 cubic inches."

In the second paragraph, delete the words "over 100 cubic inches."

SUBSTANTIATION: The volumetric limitations impose unnecessary restrictions to the usage and applications of nonmetallic boxes. The first paragraph describes normal usage. It is irrelevant to state volumetric limits. The second paragraph permits usage with metallic connections provided suitable bonding is included. Again, volumetric restriction is not significant to usage.

PANEL RECOMMENDATION: Accept as Revised:

PANEL COMMENT: Nonmetallic boxes less than 100 cu. inches are not suitable for use with all wiring methods.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COMMENT ON VOTE:

CRAMER: In our Panel discussions, pushbutton devices in nonmetallic boxes (pushbutton stations) smaller than 100 cubic inches were discussed. Pushbutton stations are not covered under Article 370 and consequently this Section does not preclude the use of such a nonmetallic station with metal raceways.

370-3: Reject

SUBMITTER: J. J. Kark, National Electrical Manufacturers Association

PROPOSAL: 3. Delete the words "not over 100 cubic inches" from the first paragraph of 370-3. Add the word "also" after "shall" in the second sentence.

The recommended text would read:

370-3 Nonmetallic Boxes. Nonmetallic boxes shall be permitted only with open wiring on insulators, concealed knob and tube wiring, nonmetallic-sheathed cable, and with rigid nonmetallic conduit.

Nonmetallic boxes over 100 cubic inches manufactured with bonding means between all raceways and cable entries shall also be permitted to be used with metal raceways and metal-sheathed cable.

SUBSTANTIATION: Needed for clarification. The wording "not over 100 cubic inch volume" is unnecessarily restrictive. The word "also" would clarify this as an additional permitted use.

PANEL RECOMMENDATION: Accept as Revised:

Add the words "in addition thereto" before the word "Nonmetallic" in the second sentence.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

AFFIRMATIVE: 11.

NEGATIVE: Barker.

EXPLANATION OF VOTE:

BARKER: All nonmetallic boxes over 100 cubic inches should have bonding means to prevent misapplication in the field with metal conduit. Grounding is an essential safety requirement.

370-3: Reject

SUBMITTER: Donald W. Cramer, St. Louis, MO

PROPOSAL: 4. In the first paragraph, eliminate "not over 100 cubic Inches."

In the second paragraph, add "Exception" prior to the first word of the paragraph.

SUBSTANTIATION: Wording is intended to clarify only. Present wording does not cover nonmetallic boxes over 100 cubic inches that are not manufactured with bonding means. The first paragraph as presently written covers only nonmetallic boxes over 100 cubic inches manufactured with bonding means.

The proposed wording should add clarity to this section. The word "Exception" is needed in the second paragraph because "only" is contained in the first paragraph.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: CMP agrees with the intent of the Proposal see action on Proposal No. 3.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
I Revise paragraph 370-6(a)(1) of the 1978 NEC as follows: add the words to the last sentence "inches, or are made from boxes and all the knock-outs are used so the grounding conductors must

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VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-6(a)(1): Accept

PROPOSAL: Revisi last sentence and add new sentence as follows:

The volume of a wiring enclosure (box) shall be the total volume of the assembled sections, and where used, the space provided by plaster rings, domed covers, etc., that are marked with their volume in cubic inches, and extension rings. The volume of extension rings shall be considered equal to the volumes shown in Table 370-6(a), for its comparable box dimensions, unless marked with a greater volume. Substantiation: The problem lies in that there seems to be some confusion, to myself and others I've been associated with, as to whether the intent and purpose of the article is to make one deduction and only one, whether the box contains just cable clamps; just fixture studs, just hickey's, or all three. I firmly believe that with my proposed it will clarify the fact that a deduction will be made when the box contains one of the above mentioned, a box containing two of the above mentioned will have two deductions, and a box with all three deductions. For example, a box containing two cable clamps and a fixture stud will have two deductions. One will be made for the cable clamps and one for the fixture

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VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-6(c): Exception-New: Reject

PROPOSAL: Amend by adding exception to read:

Exception: Conduit bodies having two entries shall be permitted to have wire to wire splices, for the connection of utilization equipment leads (including switching devices) where that equipment does not have connection space provided in it or for the connections required to change from a conduit method to a single cord method as allowed by Article 400, where the fill will not exceed 75 percent at any cross-section.

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VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-7(c): Reject

PROPOSAL: Revisi as follows:

1. Nonmetallic Boxes. Where nonmetallic boxes are used with open wiring or concealed knob-and-tube wiring, the conduits shall enter the box through individual holes. Where flexible tubing is used to encase these conductors, the tubing shall extend from the last insulating support to no less than 1/4-inch inside the box.

2. Where nonmetallic sheathed cables are used which accept only one strap, containing one or more devices, and with boxes mounted in ceilings that do not contain devices and where the cable is fastened within eight inches of these boxes, measured along the sheath, and the sheath extends into the box no less than 1/4-inch into the box, the box shall not be required. In all other instances, the cable assembly shall be secured to nonmetallic boxes.

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VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
370-7(c): Accept
SUBMITTER: CMP 9
PROPOSAL: 13A Delete the last sentence and add the following:
"In all other instances, (1) cables and (2) individual conductors of open wiring and nested and knock-out boxes, including the flexible tubing if used, shall be secured to nonmetallic boxes. Metal raceways, nonmetallic conduit, or metal-sheathed cable shall be secured to nonmetallic boxes.

SUBSTANTIATION: Clarification for first sentence. Second sentence was inadvertently left out of the 1978 NEC.

PANEL RECOMMENDATION: Accept as revised.

Revise last sentence of 370-7(c) to read: "In all other instances all permitted wiring methods shall be secured to the box measured along the sheath and the sheath extends into the box no less than 1/4 inch, securing the cable to the box shall not be required.

SUBSTANTIATION: This sentence as written in the 1978 NEC has created considerable confusion. The sentence is being rewritten to clarify its original intent.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-7(c): Reject
SUBMITTER: J.J. Kark, National Electrical Manufacturers Association
PROPOSAL: 15 Revise fourth sentence to read:
"Where nonmetallic-sheathed cable is used with boxes which accept only one trap containing one or more devices and with boxes mounted in ceilings which are for the support of a fixture, and where the cable is fastened within 8 inches of the box measured along the sheath and the sheath extends into the box no less than 1/4 inch, securing the cable to the box shall not be required.

SUBSTANTIATION: The present wording lacks clarity. In addition, it has not been demonstrated by field failures that nonmetallic cable boxes which accept one trap containing one or more devices, and with boxes mounted in ceilings which are for the support of a fixture, and where the cable is fastened within 8 inches of the box measured along the sheath and the sheath extends into the box no less than 1/4 inch, securing the cable to the box shall not be required.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Proposal action on Proposal No. 13A. Present requirement is necessary.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-7(c): Reject
SUBMITTER: H.F. van der Voort, Cleveland, OH
PROPOSAL: 16 Change sentences 4 and 5 to read: Clamping of individual conductors or cables to the box shall not be required where supported within 8 inches of the box. Where rigid nonmetallic conduit is installed with nonmetallic boxes or fittings, the conduit shall be secured to such boxes and fittings in an approved manner, which could create a potential fire hazard for lack of proper sealing of the electric box. Most home owners use the alternate method.

SUBSTANTIATION: The extra thickness of paneling when added to a wall means the electrical outlets and switches must be moved out to make them flush with the new wall surface. This is a project in itself and can be very costly and time consuming. The alternative is to seal out the electrical device which could create a potential fire hazard for lack of proper sealing of the electric box. Most home owners use the alternate method.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Present requirement is necessary as it applies to the fourth sentence. See Committee action on Proposal No. 13A for the intent of the fifth sentence.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-7(c): Reject
SUBMITTER: Idaho Chapter IAЕI
PROPOSAL: 17 Delete last two sentences.

At the end of the first sentence of 370-7(c), change the "period" to a "comma" and add "individual conductors and cables shall be secured to such boxes" to read:
"Where nonmetallic-sheathed cable is used, the cable assembly, including the sheath, shall extend into the box no less than 1/4 inch through a nonmetallic-sheathed cable knockout opening, individual conductors and cables shall be secured to such boxes.

SUBSTANTIATION: There is no assurance that the sheath of nonmetallic-sheathed cable will remain in the nonmetallic box when the device is inserted into the box. Proper sealing to the box is achieved only if the cable is stripped within 8 inches as required. It is as important that the cable sheath remains in a single gang box as any other type of box.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The present wording adequately reflects the Panel's intent. There is no evidence the present Code is inadequate.
370-11: Accept
SUBMITTER: Norman B. Cooney, Parma, Ohio
PROPOSAL: 21 After "Repairing Plaster" add "and drywall or plasterboard." [First word in sentence] add "drywall or plasterboard."
SUBSTANTIATION: Plasterboard or Drywall is used in 95 percent of today's construction so I think the remodeling or in not having included it in previous Code changes eludes me.

This paragraph, like so many others, in the Code means a specific covering "plaster" and does not address itself to other forms of wall and/or ceiling coverings.
The end result is an untenable position for the enforcing authority explaining why this also applies to other forms, plaster-content wall coverings when the Code mentions no other forms. When appeals by contractors are refused by City Building Board of Appeals, they then file in Common Pleas Court and the Judge is usually not concerned with the intent of the CMP, but the explicit wording of the article or paragraph in dispute. Since drywall construction has been used extensively since the end of World War II by builders, I believe it is time to use contemporary wording in the Code to alleviate the problems caused by outmoded building standards.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-13: Reject
SUBMITTER: Dean Woelber, Hull, IA
PROPOSAL: 25 Proposed wording of new paragraph to be added at the end of 370-13 is as follows: "Threads boxes or fittings not over 100 cubic inches in size shall be considered to be adequately supported if at least one conduit is threaded into the box wrenchtight, and is securely fastened to the surface on which it is carried as required by Articles 345-12, 136-12, and by this article. The box shall have no further means of support readily available. The conduit shall be supported at least twice, one of these supports being no further than 18 inches from the box."
SUBSTANTIATION: Many times it can be impossible to securely fasten a box exactly where it is needed or wanted, because the surface to which it should be mounted is either an irregular shape, a material such as glass, or some type of brittle plastic. In these situations, it could be just as good if not better to support the box by the conduit threaded into the box. The conduit must be supported at least twice, one with 18 inches of the box which will be a rigid support, and the second support would keep it from twisting.

PANEL RECOMMENDATION: Reject

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-14: Accept
SUBMITTER: Norman B. Cooney, Parma, Ohio
PROPOSAL: 26 After "not less than" in second sentence, delete "15/16 inches" and add "that specified in Table 370-6(a) and 370-6(b)."
SUBSTANTIATION: All devices measure 7/8 inch to 1 1/8 inches. Obviously any device measuring 15/16 inches and more cannot be used in this box so I will give this box a rigid support. Mathematically speaking, this box cannot be used for flush devices.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-17(b): Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 27 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-18(c): Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 28 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

370-13: Accept
SUBMITTER: J.J. Kark, National Electrical Manufacturers Association
PROPOSAL: 23 In first paragraph, revise second sentence to read:
Where nails are used as a mounting means and pass through the interior of the box, they shall be located so that they do not interfere with the installation of the device and are within 1/4 inch of the back of the box.
SUBSTANTIATION: For boxes such as 3-1/2 inch deep switch boxes or boxes with turned device mounting ears, through nails located within 1/4 inch of the ends of the box can give less interference and better structural support than nails within 1/4 inch of the back of the box.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
SUBSTANTIATION: The present vague and general requirements for the definition of "Approved for the Purpose" in Article 100 (definitions) would prohibit the use of custom made boxes. In instances where a one-of-a-kind box is required, boxes that are listed for use as pull or junction boxes and are an integral part of a recessed fixture or approved appliances, or Exception No. 3: Outlets supplying built-in appliances such as gas ovens and the like where there are no conductors in the outlet box except the supply conductors terminating therein and the appliance is connected to the outlet in an approved manner. 

PANEL RECOMMENDATION: Reject. 

PANEL COMMENT: Panel feels subject is adequately covered. No evidence to support the suggested change. 

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative. 

370-19: Reject 
SUBMITTER: Southwestern Section IAEI 
PROPOSAL: 30. Add a second paragraph to present Section 370-19 to read: A work space at least 18 inches horizontally and 18 inches in height shall be provided in front of each junction, pull and outlet box. Access thereto shall be provided by a space not less than 24 inches in height and 20 inches in width. Crawl holes, scuttles or similar openings to such space shall be not less than 18 inches by 18 inches in size.

Exception No. 2: Boxes approved for the purpose shall be permitted where covered by gravel-like aggregate or non-cohesive granulated soil if their location is not effectively identified and accessible for excavation; or 

Exception No. 3: Outlets supplying built-in appliances such as gas ovens and the like where there are no conductors in the outlet box except the supply conductors terminating therein and the appliance is connected to the outlet in an approved manner.

SUBSTANTIATION: The present vague and general requirements for accessibility to junction and outlet boxes are unenforceable in new construction conditions as it is not possible to know the conditions of access, especially in attic or under floor spaces, until the construction is complete. To be enforceable a specific clear area as proposed in this requirement must be stated. The proposed requirement has been in effect for many years in the City of Los Angeles and has proven to be effective, reasonable and enforceable.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Panel feels subject is adequately covered. No evidence to support the suggested change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative. 

370-19: Exception: Accept 
SUBMITTER: TSC-Approved for the Purpose 
PROPOSAL: 31. The Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100. 

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100. 

PANEL RECOMMENDATION: Accept as Revised: "Delete the word "approved for the purpose" and add the word "listed" at the beginning of the exception. 

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative. 

AFFIRMATIVE: Cramer, Deming. 
NEGATIVE: Kramer, Deming. 

EXPLANATION OF VOTE: CRAMER: Listed boxes in the size desired are not always available. Field fabrication or modification is sometimes required. Consequently, the box cannot be listed. Remove "approved for the purpose" and replace with "suitable for the environment." 

DEMING: I am opposed to the word "listed." Listed as defined in the TSC 100 definitions would prohibit the use of custom made boxes. In instances where a one-of-a-kind box is required, "listed" is not practical. Designed is a more appropriate word. 

370-20(b): Reject 
SUBMITTER: Harry Silver, Silvline, Inc. 
PROPOSAL: 32. Revise as follows: (B) Thickness of Metal. Sheet steel boxes and fittings not over 100 cubic inches in size shall be made from metal not less than .0625 inches thick. The wall of a malleable iron box, permanent-mold cast aluminum box and a die-cast or permanent-mold case metal aluminum, zinc, brass or bronze box shall not be less than 2/32 inch thick. Other cast metal boxes shall have a wall thickness of not less than 1/8 inch.

SUBSTANTIATION: The reason for the request for change is because the integrity of the die cast aluminum box will easily endure any of the impact, compression, and other mechanical strength tests that cast metal boxes are now being subjected to for similar uses and exceed requirements at the upper and lower temperature levels. Aluminum has the advantage of not needing a protective finish to provide the life tests presently required for steel boxes. The cast box has the added advantage that we can design for added wall thickness at various points of possible stress to assure the integrity of the boxes under the necessary tests. At the areas of load such as the threaded holes, the thickness can be increased to provide any mechanical strength that may be required. 

The connectors may be designed into the box at time of manufacture, eliminating possible build up of tolerance errors in assembly, and mistakes and misuse of parts. The thinner die cast boxes will be of great advantage to the industry and public in general by reducing the energy costs needed to produce the product. It will be possible to save a good quantity of material by lowering the wall thickness. Benefits are four fold - saving of energy, material, ease of use, and reduction of freight costs to job site.

A present variety of die cast boxes with .093 inch wall thickness have more than the required mechanical strength. This lighter product is more handy at the time of installation and at the same time has all benefits of boxes with thicker walls.

PANEL RECOMMENDATION: Reject. 

PANEL COMMENT: We believe the present thickness is necessary. Thickness is necessary to contain arcing faults. 

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative. 

370-20(b): Reject 
SUBMITTER: R. C. Medley, Square D Co. 
PROPOSAL: 33. Revise as follows: (B) Thickness of Metal. Sheet steel boxes and fittings not over 100 cubic inches in size shall be made from sheet steel not less than .0625 inches thick. The wall of a malleable iron box, permanent-mold cast aluminum box and a die-cast or permanent-mold case aluminum, zinc, brass or bronze box shall not be less than 3/32-inch thick unless suitably reinforced by ribs. Other cast metal boxes shall have a wall thickness not less than 1/8-inch unless suitably reinforced by ribs.

SUBSTANTIATION: Clarification of sheet steel thickness is necessary to identify the starting thickness of a drawn or bent sheet metal box where the thickness is reduced slightly by the metal forming operation with no significant loss of strength or longevity.

The omission of die-cast zinc of comparable thickness has restricted the use of an available material as corrosion resistant as aluminum. 

The reduction of minimum wall thickness for castings is now feasible by modern technology. It is no longer necessary or economical to require thickness where strength and rigidity is achievable by suitably reinforcing for hanger type installations.

PANEL RECOMMENDATION: Reject. 

PANEL COMMENT: Present requirement is necessary. The Panel does not agree with the supporting comment. Thickness is needed to contain arcing faults. 

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative. 

370-21: Reject 
SUBMITTER: R. C. Medley, Square D Co. 
PROPOSAL: 34. Revise as follows: (C) Covers. Sheet steel covers shall be made of a sheet thickness not less than .0625 inches and be suitably reinforced by ribs. Die-cast or permanent-mold cast metal covers shall be not less than 1/8-inch unless suitably reinforced by ribs. Other cast metal covers shall be not less than 2/32-inch unless suitably reinforced by ribs. 

SUBSTANTIATION: Editorial changes requested to clarify construction details. Present wording intended to correlate with Sections 370-20 and 373-10 but is ambiguous and confusing.

PANEL RECOMMENDATION: Reject. 

PANEL COMMENT: Present wording intended to correlate with Sections 370-20 and 373-10 but is ambiguous and confusing.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
Provides a Degree of Protection Against the Following Environmental Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidental contact with the enclosed equipment</td>
<td>3 3R 3S 4 4X 6 6P</td>
</tr>
<tr>
<td>Rain, snow and sleet</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td>Windblown dust</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Sleet**</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Corrosive agents</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Occasional temporary submersion</td>
<td>X X X X</td>
</tr>
<tr>
<td>Occasional prolonged submersion</td>
<td>X X X</td>
</tr>
</tbody>
</table>

*External operating mechanisms are not required to be operable when the enclosure is ice covered.

**External operating mechanisms are operable when the enclosure is ice covered.

372-6. Operating Mechanisms. Externally operated mechanisms such as circuit breakers or disconnect operating levers and other mechanisms including pushbuttons and pilot lights when installed through the enclosure wall shall provide the same degree of environmental protection as the enclosure.

SUBSTANTIATION: Type numbers have been associated with various enclosures for many years but with a somewhat lack of standardization except for a few types, and these have not been too well publicized.

Electrical contractors, electrical inspectors and users have felt a need for having a basis for selecting and accepting the proper enclosures for the various applications with proper markings to meet the requirements of Sections 110-3 and 110-11 of the National Electrical Code.

Panel Recommendation: Reject

Panel Comment: The CMP believes that extending the requirements as intended by this proposal is not appropriate at this time.

Affirmative: 11.
Negative: Barker.

Explanation of Vote:

Barker: The NEMA type numbers and classifications are used throughout the industry wherever enclosures are used, specified on plans, listed by manufacturers or suppliers. The time is long past due for the Code to be consistent with the industry and give guidance on this subject. The reasoning that industry may revise this type of numbers is unacceptable because the entire Code is always being updated and any changes in these types, etc., could be accepted as any other Code change. The time to act is now.

Article 372-(New): Reject

SUBMITTER: James M. Rice, Allen-Bradley Co.

Proposal: 36 Add a new article as follows:

ARTICLE 372-ENCLOSED APPARATUS

372-1. This article covers the general requirements for surface mounted enclosures for the following equipment rated nominally 7200 volts or less installed in nonhazardous locations: Circuit Breakers, Industrial Control Centers, Panelboards, Switchboards, Switches, Transformers.

372-2. Application to other articles. Equipment for use in hazardous locations shall conform to Articles 500 through 517.

372-3. Purpose of Enclosures. Enclosures shall be constructed to provide a degree of protection against accidental contact with enclosed equipment and to provide a degree of protection for the enclosed equipment against specified environmental conditions.

(f.p.n.) It is recognized that enclosures do not protect the enclosed equipment against conditions such as condensation, icing, corrosion or contamination which occur within the enclosure or enter via the conduit or sealed openings. 372-5. Enclosure Types. Apparatus within the scope of this article shall be marked with one or more of the following enclosure type designations:

(a) Type 1, where the enclosure is intended for only indoor use, to provide protection against contact with enclosed equipment.

(b) Type 2, where the enclosure is intended for only indoor use, primarily to provide a degree of protection against limited amounts of falling water and dirt.

(c) Type 3B, where the enclosure is intended for outdoor use, primarily to provide a degree of protection against windblown dust, rain and sleet and from external ice formation.

(d) Type 3R, where the enclosure is intended for outdoor use, primarily to provide a degree of protection against windblown dust and rain, and from external ice formation.

Table 372-4A

<table>
<thead>
<tr>
<th>Protection Against the Following Environmental Conditions</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidental contact with the enclosed equipment</td>
<td>3 3R 3S 4 4X 6 6P</td>
</tr>
<tr>
<td>Rain, snow and sleet</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td>Windblown dust</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Sleet**</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Corrosive agents</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Occasional temporary submersion</td>
<td>X X X X</td>
</tr>
<tr>
<td>Occasional prolonged submersion</td>
<td>X X X</td>
</tr>
</tbody>
</table>

Table 372-4B

Comparison of Specific Applications of Enclosures for Indoor Nonhazardous Locations

<table>
<thead>
<tr>
<th>Type of Enclosure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indoor use primarily to provide a degree of protection against contact with the enclosed equipment.</td>
</tr>
<tr>
<td>2</td>
<td>Indoor use primarily to provide a degree of protection against falling water and dirt.</td>
</tr>
<tr>
<td>3</td>
<td>Indoor or outdoor use primarily to provide a degree of protection against windblown dust, rain and external ice formation.</td>
</tr>
<tr>
<td>3R</td>
<td>Outdoor use primarily to provide a degree of protection against windblown dust and rain, and from external ice formation.</td>
</tr>
<tr>
<td>3S</td>
<td>Indoor or outdoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
<tr>
<td>4</td>
<td>Indoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
<tr>
<td>4X</td>
<td>Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water and hose-directed water.</td>
</tr>
<tr>
<td>5</td>
<td>Indoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
<tr>
<td>6</td>
<td>Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water and hose-directed water.</td>
</tr>
<tr>
<td>6P</td>
<td>Indoor or outdoor use primarily to provide a degree of protection against windblown dust, rain and splashing water.</td>
</tr>
<tr>
<td>12</td>
<td>Indoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
<tr>
<td>12K</td>
<td>Indoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
<tr>
<td>13</td>
<td>Indoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
<tr>
<td>12K</td>
<td>Indoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.</td>
</tr>
</tbody>
</table>

Table 372-4A

Comparison of Specific Applications of Enclosures for Indoor Nonhazardous Locations

<table>
<thead>
<tr>
<th>Protection Against the Following Environmental Conditions</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidental contact with the enclosed equipment</td>
<td>3 3R 3S 4 4X 6 6P</td>
</tr>
<tr>
<td>Rain, snow and sleet</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td>Windblown dust</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Sleet**</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Corrosive agents</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Occasional temporary submersion</td>
<td>X X X X</td>
</tr>
<tr>
<td>Occasional prolonged submersion</td>
<td>X X X</td>
</tr>
</tbody>
</table>

*External operating mechanisms are not required to be operable when the enclosure is ice covered.

**External operating mechanisms are operable when the enclosure is ice covered.
dust, rain and sleet and provides for operation of external mechanisms when ice laden.

(f) Type 4, where the enclosure is intended for outdoor use, primarily to provide a degree of protection against windblown dust and rain, splashing water and hose directed water under specified conditions.

(g) Type 4X, where the enclosure is intended for indoor or outdoor use, primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water and hose directed water under specified conditions.

(h) Type 5, where the enclosure is intended for only indoor use, primarily to provide a degree of protection against dust and falling dirt.

(i) Type 5P, where the enclosure is intended for indoor or outdoor use, primarily to provide a degree of protection against the entry of water during occasional, temporary submersion at a limited depth.

(j) Type 6P, where the enclosure is intended for indoor or outdoor use, primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth.

(k) Type 11, where the enclosure is intended for only indoor use, primarily to provide a degree of protection for the enclosed equipment against corrosive liquids and gases, by immersion in oil.

(l) Type 12, where the enclosure is intended for only indoor use, primarily to provide a degree of protection against dust, falling dirt and dripping water.

(m) Type 12K, where the enclosure includes knockouts that are utilized by the installer to result in an installation equivalent to Type 12.

(n) Type 13, where the enclosure is intended for only indoor use, primarily to provide a degree of protection against dust, spraying of water, oil and noncorrosive liquids.

372-7. Indoor Applications. Enclosure types appropriate for the anticipated indoor environmental conditions shall be used. Enclosures shall be selected in accordance with Table 372-7.

### TABLE 372-7: Enclosures for Indoor Nonhazardous Locations

<table>
<thead>
<tr>
<th>ENVIRONMENTAL CONDITIONS</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a Degree of Protection Against</td>
<td>1 2 4X 5 6 6P 11 12 13</td>
</tr>
</tbody>
</table>

| Incidental contact with enclosed equipment | X X X X X X X |
| Falling dirt | X X X X X X X |
| Falling liquids and light splashing | X X X X X X |
| Dust, lint, fibers and flyings | X X X X |
| Hose down and splashing water | X X X |
| Oil and coolant | X |
| Seepage | X |
| Occasional temporary submersion | X |
| Occasional prolonged submersion | X |

372-9. Outdoor Applications. Enclosure types appropriate for the anticipated outdoor environmental conditions shall be used. Enclosures shall be selected in accordance with Table 372-9.

### TABLE 372-9: Enclosures for Outdoor Nonhazardous Locations

<table>
<thead>
<tr>
<th>ENVIRONMENTAL CONDITIONS</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a Degree of Protection</td>
<td>Ty3 Ty3R Ty3S Ty4 Ty4X Ty5 Ty6P</td>
</tr>
</tbody>
</table>

| Incidental contact with enclosed equipment | X X X X X X X |
| Rain, snow and sleet | X |
| Windblown dust | X X X X X |
| Hose down | X X X |
| Occasional temporary submersion | X |
| Occasional prolonged submersion | X |

* External operating mechanisms are not required to be operable when the enclosure is ice covered.

** External operating mechanisms are operable when the enclosure is ice covered.

372-11. Materials. All enclosures shall be constructed of base materials that will not support combustion in air.

372-13. Conductor Entry. When installed, conductor entry fittings shall provide the same degree of environmental protection as the enclosure.

372-15. Operating Mechanisms. Externally operating mechanisms such as those for circuit breakers or disconnect switches, and other mechanisms including push-buttons or pilot lights when installed through the enclosure wall shall provide the same degree of environmental protection as the enclosure.

SUBSTANTIATION: This addition to the National Electrical Code will promote safety in determining the proper enclosure for electrical equipment for the environment. The enclosure type numbers in this article have been used in the trade and in industry for many years. Despite this fact, there is confusion as to the characteristics of the various type designations. Improper enclosures are the source of many accidents involving injury to workers and the large property losses. Examples of improper enclosures can be cited from numerous product liability litigations.

Electrical inspectors will find this new section particularly useful because of the clear and concise descriptions of the types of enclosures.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The CMP believes that extending the requirements as intended by this Proposal is not appropriate at this time.

AFFIRMATIVE: 11.
NEGATIVE: Barker.

EXPLANATION OF VOTE:
Barker: Same comment as Proposal No. 35.

ARTICLE 373 -- CABINETS AND CUTOUT BOXES

373: Reject

CMP 9

SUBMITTER: Eldon Homsey, Wilmington, DE

PROPOSAL: 37 All exterior or interior switch cabinets, having exposed uninsulated carrying (current carrying) components which are accessible when the cabinet door is open, shall be provided with a lock or other device to prevent children from opening them.

SUBSTANTIATION: Many existing disconnect switches, particularly on exterior air conditioning condensing units, mounted on pads on the ground, are within easy reach of curious small children. If these boxes can be easily opened, a child could touch the current carrying elements inside the cabinet and be electrocuted.

There are millions (or at least thousands) of these switch cabinets, mounted on air conditioning condensing units outside houses and garden apartment buildings all over the country, which are not locked, so as to protect children from injury or death.

Perhaps local inspecting officials should be alerted to the danger, and switch cabinet manufacturers required to provide a child-proof door catch, in addition to the padlock hasp they ready provide.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: This equipment is already provided with means for locking.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-6, 380-18 and 384-25: Accept

CMP 9

SUBMITTER: J.J. Kark, National Electrical Manufacturers Assn.

PROPOSAL: 38 Revise as follows:

373-6. No change.

(a) (No change).

Revise title of table as follows:

Table 373-6(a) - Minimum Width of Wiring Gutters and Minimum Wire Bending Space for 373-6(b)(1).

Revise present (b) as follows:

(b) Wire Bending Space at Terminal. Wire bending space at a terminal shall be provided in accordance with (1) or (2) below.

(1) Table 373-6(a) shall apply where the conductor is substantially deflected, but not more than 90 degrees and not more than once as it leaves the terminal and enters the gutter.

Table 373-6(a) shall also apply where an individual connector of the removable or lay-in type for each conductor is furnished with the equipment or designated as suitable by marking on the equipment.
TABLE 372-7-Enclosures for Indoor Nonhazardous Locations

<table>
<thead>
<tr>
<th>ENVIRONMENTAL CONDITIONS</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a Degree of Protection Against</td>
<td>1 2 4 6X 8 11 12 13</td>
</tr>
</tbody>
</table>

Incidental contact
enclosed equipment X X X X X X X X X

Falling dirt
X X X X X X X X X

Falling liquids
X X X X X X X

Light splashing
X X X X X

Dust, lint, fibers
X X X X

Flying objects
X X X X

Oil and coolant
seepage
X

Oil or coolant
spraying and splashing
X

Occasional temporary
submersion
X

Occasional prolonged
submersion
X

372-9. Outdoor Applications. Enclosure types appropriate for the anticipated outdoor environmental conditions shall be used. Enclosures shall be selected in accordance with Table 372-9.

TABLE 372-9-Enclosures for Outdoor Nonhazardous Locations

<table>
<thead>
<tr>
<th>ENVIRONMENTAL CONDITIONS</th>
<th>Type of Enclosure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a Degree of Protection Against Ty3 Ty3R Ty3S Ty4 Ty4X Ty5 Ty6X</td>
<td></td>
</tr>
</tbody>
</table>

Incidental contact
with enclosed equip-
ment
X X X X X X X X

Rain, snow
and sleet X X X X X

Windblown dust
X X X X X X X

Hosedown and splashing
water
X X X X

Oil and coolant
seepage
X

Oil or coolant
spraying and splashing
X

Occasional temporary
submersion
X

Occasional prolonged
submersion
X

* External operating mechanisms are not required to be operable when the enclosure is ice covered.
** External operating mechanisms are operable when the enclosure is ice covered.
Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall or barrier.

(c) (No change).

SUBSTANTIATION: Several proposals were made for the 1978 Code to increase wire bending space to make offset or double bends at terminal points. These proposals were based on the application of a multiplier to the existing Table 373-6(a). NEMA has sponsored a Fact-Finding Study which underwriters' laboratories have conducted under guidance of a steering committee composed of electrical inspectors, industrial users and manufacturers. The purpose of the study was to establish factual data for the next meeting necessary to make wire bends and to install wire into connectors. The Fact-Finding Report will be provided to CHP members.

Based on the results of this study, NEMA proposes the above text for 373-6(b).

The text to be provided to CHP members, Table 373-6(b) establishes increased bending space requirements for:

1. All factory-installed connectors which are not of the lay-in or removable type.
2. Field-installed connectors which are not designated by the manufacturer as part of the equipment marking.

The values in Table 373-6(b) also apply for lay-in or removable-type connectors where each connector accommodates only a single conductor. This will facilitate the use of field-installed connectors which may be dimensionally different from the connectors furnished with the equipment. This also would require manufacturers to provide adequate bending space, electrical clearances and markings for specific types of field-installed connectors.

Tests 2C, 4G, 7H, 10B, 13F, 13J and 22B demonstrate that single conductors can be installed using removable or lay-in lugs where the bending space is equal to the minimum amount required by existing Table 373-6(a). These tests cover wire sizes from #2 AWG to 750 MCM. Additional supporting tests are in process for conductor sizes No. 3, 1 and 2/0 AWG.

PANEL RECOMMENDATION: Accept as Revised:

373-6(c) No change. 373-6(a) No change. Rework the end of footnote to read: "to the wall, barrier or obstruction.

Revise 373-6(b) of the 1978 NEC to read as follows:

Table 373-6(b) - Minimum Wire Bending Space at Terminals for 373-6(b)(2) inches.

<table>
<thead>
<tr>
<th>Wire Size</th>
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<th>4 or More</th>
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<td>3</td>
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Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector to the wall or barrier.
The need for increased wiring space for the main conductors where in practically all cases this is not required to adequately wire the panelboard.

Based on the results of these tests, the proposed additions to Table 373-6(a) cover conductors which are bent or deflected more than once. Included for background is summary (pages I to 5) of Code. Disagreement on the amount of increased space led to the appointment of a steering committee to agree upon and oversee a series of tests. Such tests to determine an adequate amount of bending space are nearing completion.

The installation problems were found not only to exist in the conductor requiring bends or offsets, but, more consideration was required for the conductors that are directed straight into the terminals, thus, more bending space for all the conductors in the enclosures is needed.

Panel Recommendation: Reject.

Panel Comment: See Panel action on Proposal No. 38.

Vote on Panel Recommendation: Unanimously Affirmative.

Table 373-6(a) -- Minimum Wire Bending Space at Terminals and Minimum Width of Wiring Gutters in Inches

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<thead>
<tr>
<th>Wire Size</th>
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<td>6 (9)</td>
<td>8 (5)</td>
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<td>3-4</td>
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<td>--</td>
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<tr>
<td>250 MCM</td>
<td>--</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
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</tr>
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</tr>
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<td>1000-1250 MCM</td>
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<td>--</td>
<td>--</td>
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</tr>
<tr>
<td>1500-2000 MCM</td>
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</tbody>
</table>

Table 373-6(b) - Minimum Wire Bending Space in Inches in Enclosures Containing Terminals

<table>
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<tr>
<th>Circular M1</th>
<th>Wire Size</th>
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<td>4-8</td>
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</tr>
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<td>2</td>
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<td>250 MCM</td>
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<td>600-700 MCM</td>
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<td>750-900 MCM</td>
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<td>1000-1250 MCM</td>
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</tr>
<tr>
<td>1500-2000 MCM</td>
<td>32</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
</tr>
</tbody>
</table>

Delete fine print note from Table 373-6(a) and relocate as FPN to Table 373-6(b).
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: Patrick J. Fox, St. Louis, MO

PROPOSAL: 42 Amend Section 373-6 by adding thereto a new subsection (c) as follows:

(3) The provisions of subsections (a) and (b) of this section apply to conductors bent or deflected no more than once. For conductor bending space at terminals and width of gutter space for conductors to be bent or deflected more than once, the gutter or bending space required shall be one and one half times the value listed in Table 373-6(a). Present subsection "(c)" will become "(d)."

SUBSTANTIATION: We were convinced by the supporting comment supplied with Proposal No. 39 in the 1978 Preprint.

PANEL COMMENT: See Panel action on Proposal No. 38.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-10(a): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 43 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

Delete the words "and shall be approved for the purpose."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-10(c): Reject

SUBMITTER: Patrick J. Fox, St. Louis, MO

PROPOSAL: 44 Change paragraph to read:

"(c) Nonmetallic cabinets and cutout boxes. Nonmetallic cabinets and cutout boxes shall be approved for the purpose."

SUBSTANTIATION: This is intended to make the statement consistent with the statement for metal cabinets and cutout boxes and with Section 370-3. To require submittal for approval of every nonmetallic cabinet and box appears unnecessary if they are approved for the purpose.

This was previously submitted for the 1975 National Electrical Code and a Task Group was to have studied this proposal change.

PANEL COMMENT: Present Code wording is necessary until standards are written.

VOTE ON PANEL RECOMMENDATION: AFFIRMATIVE: 11.

NEGATIVE: 0.

CRAMER: The existing Section required approval prior to installation. Approval after installation should suffice. Sentence should read: "Nonmetallic cabinets shall be suitable for the environment."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-11(a)(3): Accept

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 45 Change paragraph to read:

"(3) Nominal Voltage: "600" in last line to "635."

SUBSTANTIATION: To conform to the method to express maximum voltage as per guidelines developed by the TSC on nominal voltage.

PANEL RECOMMENDATION: Accept as Revised:

Leave 600 as is, but insert the word "nominal" after "600."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-12-(New): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 46 Add a new section as follows:

373-12. Equipment on Cabinet Door. No device or other equipment utilizing electric wiring shall be mounted on or be supported by any cabinet or panelboard trim, cover or door - except where hinged doors designated for the purpose are employed.

SUBSTANTIATION: Switches, pushbuttons, pilot lights and similar control circuit equipment which might be mounted on a removable cabinet cover can offer a severe shock hazard to maintenance personnel. Usually the score of the cabinet is hinged on top. When the cover was opened, the manufacturer's specifications and directory could not be read. I had to lie on my stomach to inspect the equipment and on my back to read the manufacturer's specifications and directory. (And that's when the sprinkling system came on).

A sub-panel located three inches above a patio concrete slab. To inspect the installation, I had to lie on the slab as the cover was hinged on top. It was also difficult for the owner to see the circuit breakers, as the cover partially blocked his view. Whenever the patio was hosed off, which was often, the enclosure was drenched with water.

3. An overcurrent protective device and its enclosure was located on a flat roof. The enclosure was two inches above the roof. To inspect the job or to work on the equipment, a most difficult and tiring position must be maintained. A man wearing glasses would be in a dangerous position, due to the required tilt of his head, leading to poor vision, thereby contributing to a possible accident.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Supporting comment is not consistent with the proposal.

380-2(b): Reject

SUBMITTER: Ernest E. Cannon, Arizona Chapter IAEI

PROPOSAL: 49 Revise as follows:

"Neither switches nor circuit breakers shall disconnect the grounded conductor of a circuit."

SUBSTANTIATION: NFPA 70-1978 uses the word 'or' loosely without the correlation of 'either.' In many instances, this usage is not only grammatically incorrect, but the meaning is not clear.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Panel feels subject is adequately covered.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
SUBSTANTIATION: See the TSC "findings" under the definition of "approved for the purpose." Add the words "maximum" before "approved." Deliberately delete the words "approved for the purpose" and add the word "maximum." Authorize the change. The text of the chapter shall then read as follows: "Tests and the exceptions to the rules have been made without specifying the number of bends and curves. If multiconductor cables shall be used in the calculation of conduit fill and the maximum number of bends to accommodate the maximum wire size of the cable, the following should be considered: 1) The maximum number of bends shall be limited to 60 percent of the number of bends in the conduit. 2) The maximum number of bends shall be limited to 60 percent of the number of bends in the conduit. 3) The maximum number of bends shall be limited to 60 percent of the number of bends in the conduit. 4) The maximum number of bends shall be limited to 60 percent of the number of bends in the conduit. 5) The maximum number of bends shall be limited to 60 percent of the number of bends in the conduit.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 374 -- AUXILIARY GUTTERS

374-4(f)-(g): Reject

SUBMITTER: S. D. Mauney, Carolina Power & Light Company

PROPOSAL: 173 Add new (f) as follows: Where an auxiliary gutter is to contain bends or taps to an electric service, the service conductors larger than No. 1 AWG, its width at the cover shall be at least 200 percent of the width of the pipe given in Table 375-6(a) and its minimum depth from cover to cover shall be 100 percent of the width given in Table 373-6(a). Where the size of the service conductors is not readily available, the conductor size may be calculated as the equivalent size of the largest aluminum conductors with a 75°C ampacity rating equal to the sum of the service overcurrent devices tapped to the service conductors. In the table, "Wires per terminal" is to be used to indicate the number of the service conductors in parallel per phase. PANEL COMMENT: The required width of the auxiliary gutters used in service conductors and to the large size of taped connectors, the connections are under pressure from adjacent connectors, connectors, and the gutter cover. Even the best tapes are subject to abrasion due to expansion and contraction of the conductors with the load cycle. They also soften due to heat. Shorts occur when the tape is abraded or softened abnormally. More space will help connections to be positioned away from each other and from the cover. The proposed size is minimum. Experience may indicate that larger sizes may be required.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Chapter 9, Table 1, Note 5: Accept

Chapter 9, Table 1, Note 6: Reject

SUBMITTER: CMP 8

PROPOSAL: 175 Add a new Note 6 as follows:

"Jam ratio" where only three conductors are installed in a conduit, this is a ratio of the diameters of the conduit and the single conductor (D/d). This ratio is critical between 2.5 and 3.0 where the conductors are not triplexed. At a ratio of 3.0 and greater, the conduit is wider than the sum of the conductors which prevents jamping.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Chapter 9, Table 1, Note 6: Reject

SUBMITTER: CMP 8

PROPOSAL: 176 I suggest that the number of wires that is attached in 1/2 inch and 3/4 inch pipe be reduced to 1/2. The wires are 1/4 inch and 1/2 inch, respectively.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Chapter 9, Table 1, Note 6: Accept

SUBMITTER: Joseph M. Ostruthon, Sioux City, IA

PROPOSAL: 175C Add a new Note 6 as follows: "Box fill shall be permitted for triplexed conductors." PANEL COMMENT: CMP 8 would prefer to withdraw the Proposal and never to bring it back.

PANEL RECOMMENDATION: Reject.

PANEL RECOMMENDATION: See Panel Comment on Proposal No. 175B.

373-6(c)-(New)(HOD 1978 NEC): Reject

SUBMITTER: CMP 9

PROPOSAL: 42 Amend Section 373-6 by adding thereto a new subsection (c).

(c) The provisions of subsections (a) and (b) of this section apply to conductors bent or deflected no more than once. For conductor bending space at terminals and width of gutter space for conductors, the bent or deflected more than once, the gutter or bending space required shall be one and one half times the value listed in Table 373-6(a). Present subsection "c)"

SUBSTANTIATION: We were convinced by the supporting comment supplied with Proposal No. 39 in the 1978 Preprint.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-10(a): Accept

SUBMITTER: CMP 9

PROPOSAL: 43 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-10(c): Reject

SUBMITTER: CMP 9

PROPOSAL: 44 Change paragraph to read:

"Nonmetallic cabinets and cutout boxes shall be approved for the purpose."

SUBSTANTIATION: This is intended to make the statement consistent with the statement for metal cabinets and cutout boxes and with Section 370-3. To require submittal for approval of every nonmetallic cabinet and box appears unnecessary if they are approved for the purpose.

This was previously submitted for the 1975 National Electrical Code and a Task Group was to have studied this proposal change.

VOTE ON PANEL RECOMMENDATION: Reject.

373-11(a)(3): Accept

SUBMITTER: CMP 9

PROPOSAL: 45 Change "600" in last line to "635."

SUBSTANTIATION: To conform to the method to express maximum voltage as per guidelines developed by the TSC on nominal voltage.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

373-12-(New): Reject

SUBMITTER: CMP 9

PROPOSAL: 47 Add new section as follows:

"Equipment on Cabinet Door. No device or other equipment utilizing electric wiring shall be mounted on or be supported by any cabinet or panelboard trim, cover or door, except where hinged doors designed for the purpose are employed."

SUBSTANTIATION: Switches, pushbuttons, pilot lights and similar control circuit equipment which might be mounted on a removable cabinet cover can offer a severe shock hazard to maintenance personnel. Usually the screws holding the cover in place provide the equipment grounding, which means that a man removing the cover has an ungrounded piece of equipment in his hand. Furthermore, switches for disconnecting the control circuits are often within the cabinet, making it difficult to de-energize the circuit. If the cover slips during the process of removal, a live exposed terminal can be grounded to the side of the enclosure.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
380-2(b), Exception No. 2: Reject
SUBMITTER: Ernest E. Cannon, Arizona Chapter IAEI
PROPOSAL: 51 Revise as follows:
- Where either the switch or the circuit breaker etc.
- SUBSTANTIATION: NFPA 70-1978 uses the word 'or' loosely without the correlation of 'either.' In many instances, this usage is not only grammatically incorrect, but the meaning is not clear.
PANEL RECOMMENDATION: Reject.
PANEL COMMENT: No significant contribution to safety would result. This Proposal would lend itself to a false sense of security.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-3: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 53 Revise as follows:
- Wet Locations. Where either a switch or a circuit breaker (or both) is installed in a wet location shall be exposed to the weather. Section 373-2 includes both cabinets and enclosures.
- SUBSTANTIATION: NFPA 70-1978 uses the word 'or' loosely without the correlation of 'either.' In many instances, this usage is not only grammatically incorrect, but the meaning is not clear.
PANEL RECOMMENDATION: Accept as Revised:
REVISE: The first sentence of 380-3 to read: "Switches and circuit breakers shall be of the externally operable type mounted in an enclosed lister for the intended use."
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-4: Reject
SUBMITTER: Ernest E. Cannon, Arizona Chapter IAEI
PROPOSAL: 56 Revise as follows:
- The switches mentioned in the substantiation could be switches for many years. Accordingly, electricians assume that the load conductors are connected nearest the off position.
- SUBSTANTIATION: The proposed connection configuration for circuit breakers in enclosures has been an industry standard for many years. Underwriters Laboratories interprets the present code wording as not only grammatically incorrect, but the meaning is not clear.
PANEL RECOMMENDATION: Reject.
PANEL COMMENT: Same as Proposal No. 56.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-6(b): Accept
SUBMITTER: Ernest E. Cannon, Arizona Chapter IAEI
PROPOSAL: 54 Revise as follows:
- Where the throw is vertical, a locking device shall be provided to hold the blades in the open position when set.
- SUBSTANTIATION: NFPA 70-1978 uses the word 'or' loosely without the correlation of 'either.' In many instances, this usage is not only grammatically incorrect, but the meaning is not clear.
PANEL RECOMMENDATION: Accept.
PANEL COMMENT: We agree with the proposal, although his substantiation is not clear.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-8(a): Accept
SUBMITTER: Southwestern Section IAEI
PROPOSAL: 55 Revise as follows:
- Examples of switch actions not requiring tungsten test include: 61 Tungsten filament lamp loads not exceeding the amperage rating of the switch at 120 volts for single-pole, double-pole, 3-way, and 4-way switches.
- SUBSTANTIATION: The present wording does not recognize that AC type switches are designed for other than lighting loads. Examples of switch actions not requiring tungsten test include: 61 Tungsten filament lamp loads not exceeding the amperage rating of the switch at 120 volts for single-pole, double-pole, 3-way, and 4-way switches.
- PANEI RECOMMENDATION: Substitute the word "listed" for "approved.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-13(a) and (b): Accept
SUBMITTER: R. S. Pinkerton, Los Angeles, CA
PROPOSAL: 58 Add a sentence as follows:
- The supply conductors of single circuit breakers in non-bussed enclosures shall be connected to the terminals nearest the on position of the operating handle.
- SUBSTANTIATION: The proposed connection configuration for circuit breakers in enclosures has been an industry standard for many years. Accordingly, electricians assume that the load conductors are connected nearest the off position.
PANEL RECOMMENDATION: Accept:
SUBSTANTIATION: The proposed connection configuration for circuit breakers in enclosures has been an industry standard for many years. Accordingly, electricians assume that the load conductors are connected nearest the off position.
PANEL RECOMMENDATION: Accept as Revised:
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-14(a)(2): Reject
SUBMITTER: J. J. Kark, National Electrical Manufacturers Association
PROPOSAL: 61 Revise to read:
- (2) Tungsten filament lamp loads not exceeding the amperage rating of the switch at 120 volts for single-pole, double-pole, 3-way, and 4-way switches.
- SUBSTANTIATION: The present wording does not recognize that AC type switches are designed for other than lighting loads. Examples of switch actions not requiring tungsten test include: 61 Tungsten filament lamp loads not exceeding the amperage rating of the switch at 120 volts for single-pole, double-pole, 3-way, and 4-way switches.
- PANEI RECOMMENDATION: Substitute the word "listed" for "approved.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-11: Reject
SUBMITTER: R. S. Pinkerton, Los Angeles, CA
PROPOSAL: 59 In the second lines of (a) and (b) change "600V" to "600V.
- SUBSTANTIATION: The proposed connection configuration for circuit breakers in enclosures has been an industry standard for many years. Accordingly, electricians assume that the load conductors are connected nearest the off position.
PANEL RECOMMENDATION: Accept as Revised:
SUBSTANTIATION: The proposed connection configuration for circuit breakers in enclosures has been an industry standard for many years. Accordingly, electricians assume that the load conductors are connected nearest the off position.
PANEL RECOMMENDATION: Accept as Revised:
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
other than standard single pole, double pole, 3-way and 4-way switches used in lighting control circuits. The specific switches covered by this proposal are a variety of either maintained or momentary contact switches of one, two or three position single or double pole. The loads being controlled are either resistance or inductive loads, but not tungsten loads. (The panel supplied the more typical diagrams.)

The Code has been interpreted as requiring all general switches to be maintained, which inhibits design. Clarification is required to exempt these special use AC switches to allow the use of designs which maximize the performance of overcurrent protection.

**DENING:** The switches mentioned in the substantiation could be marked "not suitable for tungsten loads."

There are many instances within the Code where a product misused or used for the wrong purpose could create a hazardous condition.

**380-14(a): Accept.**

**SUBMITTER:** TSC-Approved for the Purpose. **CMP 9**

**PROPOSAL:** 62 See the technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

**SUBSTANTIATION:** See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

**PANEL RECOMMENDATION:** Accept as Revised: Change 380-14(a)(4) to 380-14(c) and revise to read as follows: "(c) CO/ALR Snap Switches. Snap switches rated 20 amperes or less directly connected to aluminum conductors shall be listed and marked CO/ALR." **VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**380-16: Accept.**

**SUBMITTER:** Submittal Nominal Voltage. **CMP 9**

**PROPOSAL:** 63 Revise the end of the second line and beginning of third line to read "knife switch rated 600 volts, etc."

**SUBSTANTIATION:** To conform to the method to express rated voltage of equipment as per the guideline developed by the TSC on nominal voltage.

**PANEL RECOMMENDATION:** Accept as Revised: Change the word "switch" to "switches." **VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**380-17, Exception-(Now): Reject.**

**SUBMITTER:** W. Creighton Schwan, Hayward, CA. **CMP 9**

**PROPOSAL:** 64 Add an exception as follows: "Fuses factory assembled in parallel, as permitted in the Exception to Section 240-8."

**EXCEPTION:** The proposed revision will remove a conflict from the Code. High voltage fuses have long been recognized in parallel when assembled in a common mounting means designed for the purpose (See Section 700-21(b)(1)).

**SUBSTANTIATION:** Article 380-8 was revised in the 1978 NEC to recognize fuses factory assembled in parallel. If fuses in parallel are recognized by the Code, the same Code must allow a switch to accommodate them.

**PANEL RECOMMENDATION:** Reject. **COMMENT ON VOTE:** See Panel action on Proposal No. 65.

**380-17-FPN (New): Accept.**

**SUBMITTER:** Idaho Chapter IAEI. **CMP 9**

**PROPOSAL:** 65 Add a FPN to 380-17 to read: See 240-8.

**EXCEPTION:** Fuses factory assembled in parallel, as permitted in the Exception to Section 240-8.

**SUBSTANTIATION:** For the purpose of better correlation in the field.

**PANEL RECOMMENDATION:** Accept. **VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**Article 304: Reject.**

**SUBMITTER:** J.J. Kark, National Electrical Manufacturers Assn. **CMP 9**

**PROPOSAL:** 66 Revise Article 304 to also specify LV switchgear (metal-enclosed low-voltage power circuit breaker switchgear). **REVIEW ARTICLE TITLE:** SWITCHBOARDS, PANELBOARDS, AND LV SWITCHGEAR. **REVISE 384-1:**

**384-1. Scope.** This Article covers (1) all switchboards, panelboards, distribution boards, and LV switchgear (metal-enclosed low-voltage power circuit breaker switchgear) installed for the control of ___ power circuits.

**Exception:** (No change). **ADD (new) 384-X:**

**384-X. LV Switchgear (Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear).** An assembly of one or more individual enclosures containing the following equipment as required: Low-voltage power circuit breakers (fused or unfused); bare bus and connections; instrument and control power transformers, instruments, meters, and relays, control signaling and auxiliary devices.

The low-voltage power circuit breakers are contained in individual grounded metal compartments and controlled either remotely or from the front of the enclosure. The circuit breakers may be stationary or removable type; when of removable type, mechanical interlocks are provided to ensure a proper and safe operating sequence.

LV switchgear assemblies are totally enclosed with no exposed live parts. **Revise 384-2:**

**384-2. Other Articles.** Switches, circuit breakers, and overcurrent devices used on switchboards, panelboards, distribution boards, or LV switchgear, and their enclosures, shall comply —____ that apply. Switchboards ____ through 517.

**Revise 384-3(a):**

(a) Conductors and busbars on a power switchboard, panelboard, control board, or LV switchgear shall be so located —____. Other than the required —____ in a vertical section of a power switchboard or LV switchgear shall be located in that section. Barriers shall be placed in all service power switchboards and LV switchgear that will isolate —____ remainder of the equipment.

**Revise 384-3(c):**

(c) Each power switchboard, LV switchgear, power switchboard or LV switchgear section, or panelboard, if used —____ to the equipment frame. All sections of a power switchboard or LV switchgear shall be bonded —____ Table 305-56.

**Revise 384-3(d):**

(d) Load terminals in power switchboards, panelboards, and LV switchgear shall be —____ connections.

**Revise 384-3(e):**

(e) On a power switchboard, panelboard, or LV switchgear supplied from a —____ marked.

**Revise 384-3(f):**

(f) The phase arrangement —____ the front of the power switchboard, panelboard, or LV switchgear shall be —____ marked.

**Revise Part A Title:** A. Switchboards and LV switchgear

**Revise 384-7:**

384-7. Clearance from Ceiling. A space —____ of any switchboard or LV switchgear —____ ceiling.

**Exception No. 1:** Where a —____ the switchboard or LV switchgear and the ceiling.

**Exception No. 2:** Totalall enclosures switchboards and LV switchgear.

**Revise 384-8:**


**Revise 384-10:**

384-10. Clearances for Conductors Entering Bus Enclosures. Where conduits or other raceways enter a power switchboard, or LV switchgear, floor standing panelboard, —____ enclosure. The wiring —____ obstructions. The conduit enclosure.

**Table**

**Revise 384-11:**


**Revise 384-12:**

384-12. Grounding of Instruments, Relays, Meters, and Instrument transformers on Switchboards and LV Switchgear. Instruments, —____ located on switchboards or LV switchgear shall be —____ through 250-125.

**SUBSTANTIATION:** Article 384 does not presently include reference to LV switchgear which is also a product designed for the control of light and power circuits. This omission causes confusion and misunderstanding about the requirements for the installation of LV switchgear for this purpose. The proposed addition of 384-X and refer to LV switchgear in the other sections of Article 384 will clarify these requirements.

**PANEL RECOMMENDATION:** Reject. **COMMENT ON VOTE:** The panel feels the scope covers switchgear.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**NEGATIVE:** Burniston.
other than standard single pole, double pole, 3-way and 4-way switches used in lighting control circuits. The specific switches covered by this proposal are a variety of either maintained or momentary contact switches of one, two or three position single or double pole. The loads being controlled are either resistance or inductive loads, but not tungsten loads. (The Panel supplied the more typical diagrams.)

The Code has been interpreted as requiring all general switches to be tungsten rated, which inhibits design. Clarification is required to exempt special use AC switches to allow the use of designs which maximize the performance on non-tungsten loads.

The switches mentioned in the substantiation could be marked "Not suitable for tungsten loads.

There are many instances within the Code where a product misused or used for the wrong purpose could create a hazardous condition.

380-14(a)(4): Accept CMR 9
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 62 See the technical subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTITUTATION: See the TSC "Findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised: Change 380-14(a)(4) to 380-14(c) and revise to read as follows: "(c) CO/ALR Snap Switches. Snap switches rated 20 amperes or less connected to aluminum conductors shall be listed and marked CO/ALR." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-16: Accept CMR 9
SUBMITTER: TSC-Nominal Voltage
PROPOSAL: 63 Revise the end of the second line and beginning of the third line to read "knife switch rated 600 volts, etc." SUBSTITUTION: To conform to the method to express rated voltage of equipment as per the guideline developed by the TSC on nominal voltage.

PANEL RECOMMENDATION: Accept as Revised: Change the word "switch" to "switches." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-17, Exception-(New): Reject CMR 9
SUBMITTER: W. Creighton Schwan, Hayward, CA
PROPOSAL: 64 Add an exception as follows: "Exception: Fuses factory assembled in parallel, as permitted in the Exception to Section 240-8. SUBSTITUTION: The proposed revision will remove a conflict from the Code. High voltage fuses have long been recognized in parallel when assembled in a common mounting means designed for the purpose (See Section 710-21(b)(1)). Section 240-8 was revised in the 1978 NEC to recognize fuses factory assembled in parallel. If fuses in parallel are recognized by the Code, the same Code must allow a switch to accommodate them.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 65.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

380-17-FPN (New): Accept CMR 9
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: 65 Add a FPN to 380-17 to read: See 240-8, Exception.

SUBSTITUTION: For the purpose of better correlation in the Field.

PANEL RECOMMENDATION: Accept. Unanimously Affirmative.

Article 304: Reject CMR 9
SUBMITTER: J.J. Kark, National Electrical Manufacturers Assn.
PROPOSAL: 65 Revise Article 304 to also specify LV switchgear (metal-enclosed low-voltage power circuit breaker switchgear). Revise Article Title: SWITCHBOARDS, PANELBOARDS, AND LV SWITCHGEAR

Revise Article 384-1: 384-1. Scope. This Article covers (1) all switchboards, panelboards, distribution boards, and LV switchgear. (metal-enclosed low-voltage power circuit breaker switchgear) installed for the control of power circuits.
Exception: (No change).
Add (new) 384-X: 384-X. LV Switchgear (Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear). An assembly of one or more individual enclosures containing the following equipment as required: Low-voltage power circuit breakers (fused or unfused); fuse and connections; instrument and control power transformers; instrument, meters, and relays, control panels and auxiliary devices. The low-voltage power circuit breakers are contained in individual grounded metal enclosures and controlled either remotely or from the front of the enclosure. The circuit breakers may be stationary or removable type. When of removable type, mechanical interlocks are provided to ensure a proper and safe operating sequence.
LV switchgear assemblies are totally enclosed with no exposed live parts.

Revise 384-2:

384-2. Other Articles. Switches, circuit breakers, and overcurrent devices used on switchboards, panelboards, distribution boards, or LV switchgear, and their enclosures, shall comply that apply. Switchboards through 217.

Revise 384-3(a):
(a) Conductors and busbars on a power switchboard, panelboard, control board, or LV switchgear, shall be so located that other than the required in a vertical section of a power switchboard or LV switchgear shall be located in that section. Barriers shall be placed in all service power switchboards and LV switchgear that will isolate the remainder of the equipment.

Revise 384-3(c):
(e) On a power switchboard, panelboard, or LV switchgear supplied from a marked.

Revise 384-3(f):
(f) Phase arrangement the front of the power switchboard, panelboard, or LV switchgear. The B phase ground. Other busbar marked.

Revise Part A Title:
A Switchboards and LV switchgear

Revise 384-7:
384-7. Clearance from Ceiling. A space of any switchboard or LV switchgear ceiling. Clearance Section No. 1 where a the switchboard or LV switchgear and the ceiling.

Exception No. 1: Total enclosure switchboards and LV switchgear.

Revise 384-8:

Revise 384-10:
384-10. Clearances for Conductors Entering Bus Enclosures. Where conduits or other raceways enter a power switchboard, LV switchgear, floor standing panelboard, enclosure. The wiring obstructions. The conduit enclosure.

Table

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Revise 384-11:

Revise 384-12:
384-12. Grounding of Instruments, Relays, Meters, and Instrument transformers on Switchboards and LV Switchgear. Instruments, located on switchboards or LV switchgear shall be through 250-165.

SUBSTANTIATION: Article 384 does not presently include reference to LV switchgear which is also a product designed for the control of light and power circuits. This omission causes confusion and misunderstanding about the requirements for the installation of LV switchgear for this purpose. The proposed addition of 384-X and refer to LV switchgear in the other sections of Article 384 will clarify these requirements.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The panel feels the scope covers switchgear.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

NEGATIVE: Burniston.

COMMENT ON VOTE: ECKARDT: To eliminate the confusion a sentence could be added to Section 384-1 namely "Where switchboards are mentioned..."
low voltage switchgear is also included."

**EXPLANATION OF VOTE:**

BURNSTON: NEMA believes that the Panel's conclusion is incorrect since LV switchgear is a specific product not already covered by the products defined as switchboards or panelboards.

384-3(a): Reject

**CMR 9**

**SUBMITTER:** G. G. Biskupek, Federal Pacific Electric Co.

**PROPOSAL:** Remove the last sentence of the text, i.e., "in order to prevent accidental contact with any conductors which are energized after the main devices in a service switchboard are turned off.",

**SUBSTANTIATION:** Need for clarification is demonstrated by field questions: Isolate to prevent fault commutation, isolate to prevent access, etc.?

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** The Code does not and cannot provide an explanation or a reason for each requirement. It would be fool-hardy to start now.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

384-3(a): Accept

**CMR 9**

**SUBMITTER:** Charles J. Hart, National Electrical Contractors Association

**PROPOSAL:** 68 Delete the second sentence of Section 384-3(a)

**EXPLANATION OF VOTE:**

HOGAN: Once again we have indicated on this proposal that we are accepting what the proponent has desired. It is my opinion that we have flatly rejected the proposal and then formed one of our own. In any event, I am voting negatively. Quite possibly, if we had used the word raceway or something similar to that in lieu of the word barrier, I would have a different opinion about the proposal as formulated. I am completely opposed to the original proposal.

LEIMAN: The New York City code has had this requirement for the last 12 years without causing any problems to the installer. The Panel Recommendation will cause switches to be loaded with metal barriers. This will lead to hazardous conditions. Since the 1976 Code became effective, I have never received any negative comments from the field at any of the IAEI meetings.

LEIMAN: I agree with the concept of the proposal, but the substantiation offered is not correct. The shop drawings generally are submitted by the manufacturers for approval of the switchboard and approved by the Engineer before the SMBO is fabricated. The installer should be familiar with the location and arrangement of protective devices.

**CMR 9**

**SUBMITTER:** J. J. Hart, National Electrical Contractors Association

**PROPOSAL:** 70 Revise, as follows:

The phase arrangement on three phase buses shall be A,B,C from front to back, top to bottom, or left to right, as viewed from the front of the switchboard or panelboard. The C phase shall be that phase having the higher voltage to ground. Other busbar arrangements shall be permitted for the purpose is used for service equipment.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

384-3(f): Reject

**CMR 9**

**SUBMITTER:** A.G. Aschenbeck, Wayzata, MN

**PROPOSAL:** 71 Add a second paragraph as follows:

Busbars that are not insulated increase the likelihood of personnel who install and maintain electrical equipment.

**CMR 9**

**SUBSTANTIATION:** Most electricians and inspectors do not realize that when a switchboard panel is used with nonmetallic raceway or cable, or service equipment.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** This proposal will clarify the system addressed in this requirement. A 3-phase, 3-wire corner (B-phase) grounded system cannot meet a requirement that B-phase be the highest voltage to ground.

384-3(c): Reject

**CMR 9**

**SUBMITTER:** Robert W. Gilmore, Northwest Iowa Technical College

**PROPOSAL:** 70 Add a second paragraph as follows:

Also provisions shall be provided for the installation of the switchboard or panelboard for the attachment of all the feeder and branch-circuit equipment grounding conductors, where the panelboard is used with nonmetallic raceway or cable, or where separate equal ground conductors are provided. The terminal bar shall be bonded to the cabinet or panelboard frame and shall not be connected to the neutral bar in other than service equipment.

**CMR 9**

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** The present wording adequately reflects the Panel's intent.

384-3(f): Accept

**CMR 9**

**SUBMITTER:** A.G. Aschenbeck, Wayzata, MN

**PROPOSAL:** 71 Revise, as follows:

The phase arrangement on three phase buses shall be A,B,C from front to back, top to bottom, or left to right, as viewed from the front of the switchboard or panelboard. The C phase shall be that phase having the higher voltage to ground. Other busbar arrangements shall be permitted for the purpose is used for service equipment.

**PANEL RECOMMENDATION:** Unanimously Affirmative.

384-3(h)-(New): Accept

**CMR 9**

**SUBMITTER:** Robert J. Freund, Chicago, IL

**PROPOSAL:** 72 Add new (h) as follows:

All busbars in equipment that operates at voltages over 250 volts between phases or between any phase and ground and designed to carry currents of 1000 amperes or greater shall be insulated. The insulation shall be solid, mechanically secure, and suitable for the operating voltage.

**CMR 9**

**PANEL RECOMMENDATION:** Accept as Revised.

**Secretary's Note:** It was the action of the Correlating Committee that this Proposal be reported as a 'reject,' because less than two-thirds of the members eligible to vote have not voted in the affirmative.

**SUBMITTER:** Robert J. Freund, Chicago, IL

**PROPOSAL:** 72 Add new (h) as follows:

All busbars in equipment that operates at voltages over 250 volts between phases or between any phase and ground and designed to carry currents of 1000 amperes or greater shall be insulated. The insulation shall be solid, mechanically secure, and suitable for the operating voltage.

384-3(h)-(New): Accept

**CMR 9**

**PANEL RECOMMENDATION:** Unanimously Affirmative.

384-3(a): (NM 1978 NEC): Accept

**CMR 9**

**SUBMITTER:** NEMA

**PROPOSAL:** Delete the second sentence of this Section.

**SUBSTANTIATION:** Compliance with this requirement is next to impossible. In multi-section switchboard installations, it is often unknown to the installer in what section a particular overcurrent device is located.

Moreover, decisions to relocate circuit entrances into the switchboard section are often made in the field, particularly where there are obstructions or conflicts with other equipment. This requirement necessitates extensive switchboard modification in these instances.

Most switchboards have large open spaces without barriers between adjacent sections. Fires can communicate between sections even if there are no conductors common to adjacent sections. The interconnects between switchboards are often made with insulated conductors capable of transmitting fire to the adjacent section. This requirement does not add a responsible degree of safety for these conditions.

**CMR 9**

**PANEL RECOMMENDATION:** Accept as Revised:

Revise as in Proposal No. 69.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

384-3(f): Reject

**CMR 9**

**SUBMITTER:** A.G. Aschenbeck, Wayzata, MN

**PROPOSAL:** 71 Revise, as follows:

The phase arrangement on three phase buses shall be A,B,C from front to back, top to bottom, or left to right, as viewed from the front of the switchboard or panelboard. The C phase shall be that phase having the higher voltage to ground. Other busbar arrangements shall be permitted for the purpose is used for service equipment.

**CMR 9**

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** This proposal will clarify the system addressed in this requirement. A 3-phase, 3-wire corner (B-phase) grounded system cannot meet a requirement that B-phase be the highest voltage to ground.

384-3(f): Accept

**CMR 9**

**SUBMITTER:** A.G. Aschenbeck, Wayzata, MN

**PROPOSAL:** 71 Revise, as follows:

The phase arrangement on three phase buses shall be A,B,C from front to back, top to bottom, or left to right, as viewed from the front of the switchboard or panelboard. The C phase shall be that phase having the higher voltage to ground. Other busbar arrangements shall be permitted for the purpose is used for service equipment.

**CMR 9**

**PANEL RECOMMENDATION:** Unanimously Affirmative.
Ground fault protection only covers certain limited faults and increases the likelihood of internal faults.

Insulated busbars provide personnel safety and continuity of service at a low cost.

PANEL RECOMMENDATION: Accept as Revised:

"All busbars in solidly grounded wye switchboards that operate at voltages over 250 volts to ground but not exceeding 600 volts phase to phase and rated 1000 amperes or greater shall be insulated except bolted joints and connections."

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 11
NEGATIVE: Hogan, Burniston, Cock, Crامر, LaMorte.

COMMENT ON VOTE:

BARKER: I voted affirmative as the Panel Recommendation is better than nothing. In time it will again require another change to comply with the original proposal. Insulated busbars would greatly reduce the magnitude and resulting hazards of busbar failures from busbar to busbar. Therefore, it is in the interest of safety to begin moving towards this goal.

LEIMAN: I haven't voted negatively on this proposal but would like to be on record to discuss this at our next meeting in December. It would be an input when I attend our IAEI Sectional meetings.

EXPLANATION OF VOTE:

Hogan: I have voted negatively on this proposal for two reasons: (1) to call as much attention to the proposal as is possible and (2) to give the Panel another opportunity to discuss the Proposal. I am not satisfied that we have actually accomplished what we intended.

Burniston: This proposal imposes a design requirement on equipment presently owned by American National Standards and Underwriters Laboratories Inc. standards which deliberately do not include this requirement.

This type of question is not intended to be installed or maintained while energized.

Incomplete insulation as specified in this proposal will lead to a false sense of security on the part of personnel and will encourage the unsafe practice of working on energized equipment.

Addition of insulation to busbars in this equipment will lead to voltage stress concentrations on the insulation and result in failures of the insulation which may cause equipment failure instead of preventing it.

These products have been built, have not experienced a history of power interruptions and personnel safety hazard sufficient to justify this requirement.

Cock: I feel that we should be inspected within this voltage range there should be an exception in Section 230-95 which would not require ground fault protection of equipment for insulated busbars.

The Panel has recognized that bolted joints and connections cannot be insulated. I submit that the condition of "insulated busbars" and "uninsulated busbars" tends to give the workman a false sense of security since he tends to assume he is working on an "insulated system."

Cramer: I disagree with the supporting comment that busbars that are not insulated are a hazard to personnel who install and maintain electrical equipment. Good safety practices can accomplish much more than any form of insulation.

Bare busbars are allowable when located outside of enclosures provided they are suitably guarded. (See Section 110-17(a).)

Here in a switchboard which already meets requirements of 110-17(a), we are requiring additional insulation which will be hard to determine which main device feeds which sub-busbar, the bus assembly from the rear of the switchboard is not accessible thereby making it hard to determine which main device feeds which group of sub-devices. Some switchboards with insulated buses make it hard to identify line and load connections. Lack of identification presents an obvious hazard to workmen.

PANEL RECOMMENDATION: Reject.

Panel Comment: Supporting comment is not persuasive as to necessity.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 11
NEGATIVE: Leiman.

EXPLANATION OF VOTE:

Leiman: I agree with the supporting comment.

384-3-(New): Rejected

SUBMITTER: Donald C. Smith, Texas Chapter IAEI

PROPOSAL: 73 (Add (h) as follows):

Any multi-section service switchboard incorporating multiple main overcurrent devices feeding subsections within the same switchboard shall indicate by use of permanent mica bus on the face of the switchboard the busbar schematic of that switchboard.

SUBSTANCIATION: For many years design engineers have recognized the need for mica bus on the front of switchboards for the safety of personnel and identification. Failure to do so will result in failure of the insulation which may cause equipment failure instead of preventing it.

Cock: This proposal imposes a design requirement on equipment presently owned by American National Standards and Underwriters Laboratories Inc. standards which deliberately do not include this requirement.

This type of question is not intended to be installed or maintained while energized.

Incomplete insulation as specified in this proposal will lead to a false sense of security on the part of personnel and will encourage the unsafe practice of working on energized equipment.

Addition of insulation to busbars in this equipment will lead to voltage stress concentrations on the insulation and result in failures of the insulation which may cause equipment failure instead of preventing it.

These products have been built, have not experienced a history of power interruptions and personnel safety hazard sufficient to justify this requirement.

Cock: I feel that we should be inspected within this voltage range there should be an exception in Section 230-95 which would not require ground fault protection of equipment for insulated busbars.

The Panel has recognized that bolted joints and connections cannot be insulated. I submit that the condition of "insulated busbars" and "uninsulated busbars" tends to give the workman a false sense of security since he tends to assume he is working on an "insulated system."

PANEL RECOMMENDATION: Reject.

Panel Comment: Supporting comment is not persuasive as to necessity.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 11
NEGATIVE: Leiman.

EXPLANATION OF VOTE:

Leiman: I agree with the supporting comment.

384-6-(New): Accept

Secretary's Note: It was the action of the Correlating Committee that the Panel shall delete reference to new and existing installations. The addition of a paragraph following 384-2:

"Although the NEC prohibiting installation of metal clad switchgear, THE INSULATION IS NOT DESIGNED TO PROTECT AGAINST ELECTRICAL SHOCK. CONTACT WITH THIS BUS OR ITS CONNECTIONS SHOULD BE AVOIDED WHEN THE SWITCHGEAR IS ENERGIZED." (The capitals are as in the NEC No. 70-8 text.)

Submitter alleges that busbars that are not insulated increase the likelihood of power interruptions of vital electrical systems that affect the public safety. No evidence has been submitted to substantiate this claim - merely hearsay. In fact, if low-voltage systems were forced to be insulated failure due to insulation breakdown would increase, resulting in more power interruptions.

Submitter alleges that implementation of this proposal can be accomplished at low cost. This statement is not backed up with any cost analysis; consequently, it is unfounded. It is expected that cost of switchgear and power distribution equipment would increase dramatically. Existing switchgear
designed, constructed or erected, an electrical service, distribution, transformer or control equipment shall be located in rooms or spaces dedicated exclusively to such equipment. No foreign piping, ducts or other mechanical or architectural equipment or apparatus may be permitted to be installed in, enter or pass through such spaces or rooms.

(b) Existing Buildings. Previously approved electrical installations and distribution systems are being installed shall conform to the provisions of paragraph (a) of this section.

Exception No. 1: Control equipment which by its very nature or because of rules of this Code must be adjacent to or within sight of its operating machinery.

Exception No. 2: Ventilating, heating or cooling equipment that serves the spaces or rooms.

Exception No. 3: Transformers, controllers, switches and distribution equipment located throughout industrial plants which is isolated from foreign equipment by height or physical enclosures which will afford adequate mechanical protection from vehicular traffic, accidental contact by unauthorized personnel or accidental spillage or leakage from piping systems.

Exception No. 4: Outdoor electrical equipment located in weatherproof enclosures protected from accidental contact by unauthorized personnel or vehicular traffic or accidental spillage or leakage from piping systems.


NEGATIVE: Bramann, Cramer, Larmore.

COMMENT ON VOTE:

DEERING: While the concept can be supported terms such as "fireproof building" and "existing buildings" would clearly disfranchise the application of the code rules no matter how hazardous the condition.

CRAMER: When this amendment to the proposal was originally considered, it appeared desirable. Later reflection on it has uncovered some deficiencies.

(1) Interpretation of what constitutes a space can vary from person to person. Some industry users, for example, consider a room to be a space defined in Article 110. Are spaces totally enclosed or merely a screened area? Some might consider a violation because of machinery and piping in the same room with electrical others that do not consider a violation because of the electrical gear in its own space. Similarly in a home, the amount of space required for a service entrance panelboard is vague.

(2) Industrial control rooms with operator attended control panels would fall under this section. Desks, file cabinets, drinking fountains and other accessories are included in these rooms and would be in violation of the proposal.

(3) The exceptions themselves appear incorrectly located after paragraph (c). They appear to be more logically located after paragraph (a).

LAMORTE: At a glance it appeared that this proposal, with some modifications, would be one good. The revised proposal taking it part by part was a disappointment, and I have voted negative for the following reasons:

1. There seems to be a lack of definition to "Spaces or Rooms." Is space, which is space as defined in Article 110? Are rooms totally enclosed or merely a screened area?

2. Section 450-47 on Transformers does not consider piping for fire protection of electrical installation. Would the proposed Section 384-2 permit sprinkler piping for a unit substation line-up consisting of primary switches, transformer and low voltage switch?

3. In paragraphs (c) who could determine if a building is being remodeled more than 50 percent? If a building is required to be remodeled and greater than 50 percent of the building is needed to get NEC would be to complete the installation in several different phases.

4. The objection I have about the 4 exceptions is that it expands the scope of the Article which should be confined to Switchboards and Panelboards.

384-16(a): Reject

SUBMITTER: Raleigh W. Rhudy, Jr., Hueytown, AL

PROPOSAL: 79 Add the words "one and after the words "on the supply side by." Revise Exception No. 2 as follows: Delete Exception No. 2 - Individual protection for lighting and appliance branch-circuit panel boards is not required where such panelboards are used as service equipment in supplying service to signs, pumps and equipment separate from buildings of occupancy.

SUBSTANTIATION: Since the words from the 1975 NEC Section 384-16(a), Exception No. 2 - and where any bus supplying 15- or 20-ampere circuits is protected on the supply side by an overcurrent service, have been deleted from the 1978 NEC Section 384-16(a), Exception No. 2. The Code does not require a main disconnect or overcurrent service for service equipment of residential housing. This constitutes a conflict and confusion between Section 384-16(a), Exception No. 2 and Section 230-79(a) through (d) besides the need for the protection of equipment and safety of persons.

This proposal and any improvements are for consideration to
### Proposed Changes and Discussions

**SUBSTANTIATION:** This section is practicably unenforceable because it requires an unjustified increased cost for main circuit breaker. **VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

#### 384-16(a), Exception No. 2: Accept

**SUBMITTER:** Idaho Chapter IAEI

**PROPOSAL:** Delete 384-16(a), Exception No. 2.

**SUBSTANTIATION:** This is a subject that has come up in every Code for a number of years and has been rejected or blocked every time. It is not quite clear as to why the reason except that the supporting comment of the "con" nature seems to reiterate the thought that no one has been electrocuted, injured, or there are not any fire records showing contributory factors to this exception. It seems that some pressures are applied in areas beyond the Code Making Panel's jurisdiction because Proposal No. 83 in the Preprint for the 1978 Code was submitted and accepted by Code Making Panel 9. This seems to indicate that politics has a greater bearing on Code making than the desire for having compatible Code especially when the negative pressures come from the segments not regulated by the NEC requirements. In other words, why is a residential service permitted to have equipment that is not only less restrictive than the other occupancies but can be more easily tampered with by inexperienced persons just because they feel they can do so as they please with what they own even though it may endanger their next-door neighbor.

Proposal No. 83 page 204 of the 1978 NEC Preprint evidence that it is prime time that this exception be retired from the NEC.

**PANEL RECOMMENDATION:** Accept as Revised:

- **ADD TO EXCEPTION No. 2 at beginning of sentence: "For existing installations, the voltage shall remain steady and not exceed 10 feet."**
- **AFFIRMATIVE:** All.
- **NEGATIVE:** Biermann.

**EXPLANATION OF VOTE:**

- **BIERMANN:** I am in favor of the proposal. I am not in favor of establishing one standard for existing dwellings and another for new dwellings.

#### Typical Transformer Ratings

<table>
<thead>
<tr>
<th>Voltage (kVA)</th>
<th>Phase Current (amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>41.7</td>
</tr>
<tr>
<td>30</td>
<td>83.4</td>
</tr>
<tr>
<td>45</td>
<td>125.0</td>
</tr>
</tbody>
</table>

The overcurrent protection of a 1.5 kVA unit substation with a full load current of 41.7 amperes, 15 ampere branch-circuit breaker, and 100 amp standard panelboard bus, is not enhanced with the standard 100 amp transformer secondary main breaker rated at over twice full load (calibrated to trip in 6 minutes at 200 amperes—UL489).

A branch-circuit fault close to the panelboard is seen by the instantaneous elements in both the main and the corresponding branch-circuit breaker. This can drop all the substation load possibly creating an unsafe condition due to a complete loss of protection to critical process instruments or to the area lighting being served.

The identification and marking of each branch circuit is already a requirement of NEC 110-22 and assists in monitoring the load connected to each phase.

I believe that the restrictions of this proposal exceed those allowed under 384-16(a) Exception No. 2 for a safe installation.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 80.

#### 384-17-(New): Accept

**SUBMITTER:** Samuel S. Levinrad, VA, Wash., DC

**PROPOSAL:** Remove existing Section 384-17 and add new 384-17 as follows:

384-17. Water pipes and accessories. No piping or duct system foreign to the electrical installation, shall be located in the vicinity of panelboards and service equipment, or pass through rooms specifically designed to house this type of equipment. No piping or air conditioning duct system, other than those systems which serve the electrical equipment space, shall be located in the vicinity of any switchgear, panelboards or service equipment and shall not pass through rooms or architectural space specifically provided for the housing of such equipment.

**SUBSTANTIATION:** Sections 450-47 and 710-9 are the only areas within the NEC prohibiting foreign piping (water pipes) in areas containing electrical equipment. With the advent of the large office and apartment building construction, there is more and more economical to purchase primary voltage power, feed through the switchgear, substation to utilization voltage and distribute throughout the complex. We have seen hospitals, office buildings and apartment houses wherein chilled water pipes, steam pipes, cold water pipes, sanitary cleanouts, pass directly over the building's secondary or primary switchgear. In addition, some architects still utilize the electrical closets as a chase for other than electrical conduit. The addition of a paragraph such as recommended will add the inspection authority having jurisdiction in performing its function and assure a safer installation.

**PANEL RECOMMENDATION:** Accept as Revised.

**VOTE ON PANEL RECOMMENDATION:**

- **AFFIRMATIVE:** 11.
- **NEGATIVE:** Biermann, LaMorte.

**COMMENT ON VOTE:**

- **ECKARDT:** See my comments on Proposal No. 74.
- **COMMENTS:** An "Exception No. 5" should be added for one and two family dwellings.

**EXPLANATION OF VOTE:**

- **BIERMANN:** See my comments on Proposal No. 74.

**LaMORTE:** See comments on Proposal No. 74.

#### 384-18: Accept

**SUBMITTER:** TSC-Approved for the Purpose

**PROPOSAL:** See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

**SUBSTANTIATION:** See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

**PANEL RECOMMENDATION:** Accept as Revised:

- **AFFIRMATIVE:** 9.
- **NEGATIVE:** Hogan, Barker, Cranker.
EXPLANATION OF VOTE:

BARKER: We do not agree with the supporting comment and do not believe that the Proposal accomplishes what the submitter intended.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

384-22: Reject

SUBMITTER: J.A. Fehr, General Electric Co

PROPOSAL 85: Revise as follows:

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384-22: Bussbars. Bussbars may be copper or aluminum. If rigidly mounted, they may be bare.

SUBSTANTIATION: Section 110-5 states "Conductors normally used to carry current shall be of copper unless otherwise provided in this Code."

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384-23: Not over 127 volts; Not over 635 volts.

SUBSTANTIATION: To conform to the method to express maximum voltage as per guidelines developed by the TSC on nominal voltage.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 384-26: Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL 86: The voltage designation in Column 1 should be changed to:

---

Not over 325 volts; Not over 500 volts.

SUBSTANTIATION: To conform to the method to express maximum voltage as per guidelines developed by the TSC on nominal voltage.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

384-27: Accept

SUBMITTER: CMP 9

PROPOSAL 86: Add a new exception as follows:

---

Exception No. 2: The terminal bar for equipment grounding conductors shall be permitted to be connected to the neutral bar at separate buildings in accordance with the provisions of Section 250-24, Exception No. 2.

SUBSTANTIATION: This is to correct a conflict. Where the grounded circuit conductor is grounded at a separate building in accordance with Section 250-24, the terminal bar for equipment grounding conductors must be bonded to the neutral bar in order to complete the ground-fault current path to the service.

VOTE ON PANEL RECOMMENDATION: Accept as Revised:

AFFIRMATIVE: 11.

NEGATIVE: Barker.

EXPLANATION OF VOTE:

BARKER: In accord with Articles 230 and 250, when the conductors enter the second building they are service conductors to that building except for the exceptions. To add this to this section would be confusing and could result in improperly grounded installation with resultant hazards. We should leave services and grounding to the appropriate Panel, with only a cross-reference in this Section.

384-XX: (New): Accept

SECRETARY'S NOTE: It was the action of the Correlating Committee that the Panel shall delete reference to new and existing installations. The application of installation rules is the function of the authority enforcing the Code.

SUBMITTER: TSC-Nominal Voltage

PROPOSAL 89: Add section as follows:

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384-XX: Electrical switchboards, electrical controls or control panels other than those related to the Mechanical Code shall not be located in any machinery room.

SUBSTANTIATION: The following problems have arisen due to the electrical requirements included in other uniform codes. Too often this requirement can be overlooked from the standpoint of design and plan check, therefore, creating a situation that can result in erroneous results in order to satisfy all model code requirements after the installation has been made. I feel that the electrical requirements included in other codes should be cross-referenced back to this Code.

The 1976 edition of the Uniform Mechanical Code will allow the following equipment in a machinery room:

1. Lights and receptacles
2. Machinery room exhaust fans and blowers
3. Any refrigerating condensing unit or portion thereof
4. Circulating pumps for condensers, cooling towers, or cooling coils
5. Air compressors serving only automatic controls within the refrigerating or cooling system
6. Electrically operated valves for the control of a refrigerant or for the control of the circulation of a cooling fluid
7. Blowers and fans for cooling towers or for condensers
8. Any electric control or control panel for any of the above items.

A readily accessible single emergency refrigeration control switch shall be provided to shut off all electrically operated machinery in any machinery room, except the exhaust ventilation system complying with UMC Section 1508. Such switch shall be located from a point outside of, and within ten feet of the required opening to the machinery room it serves, and the switch shall be labeled to comply with UMC Section 1519. Except as modified by this act, the switch and equipment shall comply with the applicable requirements of Chapter 1 through 4.

VOTE ON PANEL RECOMMENDATION: Accept as Revised:

AFFIRMATIVE: 9.

NEGATIVE: Biermann, Cramer, LaMorte.
COMMENT ON VOTE:
COCK: An "Exception No. 5" should be added for one and two family dwellings.
EXPLANATION OF VOTE:
BIERMANN: See my comments on Proposal No. 74.
CRAMER: See comments on Proposal No. 74.
LaMORTE: See comment for Proposal No. 74.

384-XX-(New): Accept CMP 9
Secretary's Note: It was the action of the Correlating Committee that the Panel shall delete reference to new and existing installations. The application of installation rules is the function of the authority enforcing the Code.
SUBMITTER: George Alexander, Fresno, CA

PROPOSAL: 90 Electrical switchboards, electrical controls or control panels other than those related to the Mechanical Code shall not be located in any machinery room.

SUBSTANTIATION: The following problems have arisen due to the electrical requirements included in other uniform codes. Too often this requirement can be overlooked from the standpoint of design and plan check, therefore, creating a situation that can result in enormous cost in order to satisfy all model code requirements after the installation has been made. I feel that the electrical requirements included in other codes should be cross-referenced back to this Code.
The 1976 edition of the Uniform Mechanical Code will allow the following equipment in a machinery room:
1) Lights and receptacles
2) Machinery room exhaust fans and blowers
3) Any refrigerating condensing unit or portion thereof
4) Circulating pumps for condensers, cooling towers, or cooling coils
5) Air compressors serving only automatic controls within the refrigerating or cooling system
6) Electrically operated valves for the control of a refrigerant or for the control of the circulation of a cooling fluid
7) Blowers and fans for cooling towers or for condensers
8) Any electric control or control panel for any of the above items

A readily accessible single emergency refrigeration control switch shall be provided to shut off all electrically operated machinery in any machinery room, except the exhaust ventilation system complying with UMC Section 1508. Such switch shall be controlled from a point outside of, and within ten feet of, the required opening to the machinery room it serves, and the switch shall be labeled to comply with UMC Section 1519. Except as modified by this article, wiring and equipment shall comply with the applicable requirements of Chapter 1 through 4.

PANEL RECOMMENDATION: Accept as Revised:

VOTE ON PANEL RECOMMENDATION:
AFFIRMATIVE: 9.
NEGATIVE: Biermann, Cramer, LaMorte.

COMMENT ON VOTE:
COCK: An "Exception No. 5" should be added for one and two family dwellings.
EXPLANATION OF VOTE:
BIERMANN: See my comments on Proposal No. 74.
CRAMER: See comments on Proposal No. 74.
LaMORTE: See comment for Proposal No. 74.
be permitted to be used at the ampacities shown in the tables of this article which are now specified in Articles 210, 220, 230, 240, 250, 280, 384, 410, 420, 440, 517.

This section shall become effective January 1, 1985.

SUBSTANTIATION: Problem - Terminal restrictions imposed upon conductors 600V and above are double insulation technology based. These restrictions cause under-utilization of conductors and raceway systems. This under-utilization causes excess costs for both materials and laboring both natural resources and energy.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 400-4: Rejected.

CMPL: William H. Korczi, Shell Development Co./Shell Chemical Co.

PROPOSAL: 65 Add the following new designation type letters to Table 400-4 in the applicable service cord (SP, SV, SJ, S; SDR) sections as shown in Table and include a new Note 10 as follows:

SUBSTANTIATION: The current NEC designation system for service type flexible cords (Article 400) does not provide for a broad group of acceptable materials and outer coverings based upon thermoplastic rubber materials. What we propose is a revision to the Table as shown in the accompanying appendices which will provide the necessary differentiation of this group from currently designated "rubber" and "thermoplastic" insulation and outer coverings.

The substantiation for this proposal has two aspects:
1. (1) performance and fabrication considerations, and
2. the expressed need by cable producers and users to develop this new designation for thermoplastic rubber materials.

Detailing of arguments arising from these viewpoints is found in the accompanying appendices to this proposal:

APPENDIX 1: Summary
APPENDIX 2: Introduction, general background, acceptance and performance, history, terminology and definitions associated with thermoplastic rubbers
APPENDIX 3: Performance considerations based upon UL fact finding programs and UL No. 62 listings
APPENDIX 4: New type designation survey of cable manufacturers and users.

Appendices have been supplied to CMP members.

PANEL RECOMMENDATION: As Revisited:

"Delete hyphens (7 places) in type letters preceding "E" in proposed additions to Table. Delete proposed Note 10 and all references to Note 10.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
subject article restricts this use to a shielded pair.

**Panel Recommendation:** Accept

**Vote on Panel Recommendation:** Unanimously Affirmative.

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Table 400-4, Note No. 7: Reject

**Submitter:** R. Broste, National Elevator Industry, Inc.

**Proposal:** 69 Omit present wording of Note 7 and substitute the following:

"A separate conductor in these cables shall be available for grounding purposes only."

**Substantiation:** This note refers to "a third conductor in these (elevator) cables is for grounding purposes only." An elevator cable has a multitude of conductors. A "third conductor" has no meaning.

**Panel Recommendation:** Reject.

**Panel Comment:** Note 7 is not applicable to elevator cables in Table 400-4.

**Vote on Panel Recommendation:** Unanimously Affirmative.

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<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Type Letter</th>
<th>Insulation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum Cleaner</td>
<td>SVO0</td>
<td>OIi Resistant Thermoplastic</td>
<td>All columns identical to SVO</td>
</tr>
<tr>
<td></td>
<td>SV100</td>
<td>OIi Resistant Thermoset or Thermoplastic</td>
<td>All columns identical to SV10</td>
</tr>
<tr>
<td>Junior Hard Service</td>
<td>SJ00</td>
<td>OIi Resistant Thermoset or Thermoplastic</td>
<td>All columns identical to SJ0</td>
</tr>
<tr>
<td>Service Cord</td>
<td>S000</td>
<td>OIi Resistant Thermoset or Thermoplastic</td>
<td>All columns identical to S0</td>
</tr>
<tr>
<td>Hard Service Cord</td>
<td>S000</td>
<td>OIi Resistant Thermoset or Thermoplastic</td>
<td>All columns identical to S0</td>
</tr>
<tr>
<td></td>
<td>ST00</td>
<td>OIi Resistant Thermoset or Thermoplastic</td>
<td>All columns identical to ST0</td>
</tr>
</tbody>
</table>

**Substantiation:** 1. Based on test work and discussion with users, manufacturers, and inspection authorities, UL has declined to list "Rubber" cords employing elastomeric (rubber) compounds which were not thermostet. Consequently, there are no proposals to revise the 1978 NEC to recognize new types employing "thermoplastic elastomers." The above revisions are necessary in order to clearly differentiate the three types.

2. To make intent clearer.

3. UL has listed these new types to give recognition to cords with oil resistant insulations as well as jackets.

**Panel Recommendation:** Accept.

**Vote on Panel Recommendation:** Unanimously Affirmative.

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Table 400-4 and 400-5: Accept

**Submitter:** Austin D. Wetherell, Underwriters Laboratories Inc.

**Proposal:** 70 Substitute the word "thermostet" for the word "rubber" in Notes 6, 8 (line 4 only), and 9 to Table 400-4; Table 400-4 in its entirety; and Table 400-5 column headings.

**Substantiation:** Many Flexible Cords and/or cables are listed in Tables 400-4 through 400-5 as having 2 or more conductors. The Ampacity rating described in Table 400-5 does not recognize cords/cables or more than 3 conductors.

**Panel Recommendation:** Accept as Revised.

**Vote on Panel Recommendation:** Unanimously Affirmative.

---

**Proposal:** 73 Change the second sentence to the following:

"If the number of current-carrying conductors in a cord exceeds 3, the maximum allowable load current of each conductor shall be reduced as shown in the following table:

<table>
<thead>
<tr>
<th>Number of Conductors</th>
<th>Percent of Values in Table 400-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 through 6</td>
<td>80</td>
</tr>
<tr>
<td>7 through 24</td>
<td>70</td>
</tr>
<tr>
<td>25 through 42</td>
<td>60</td>
</tr>
<tr>
<td>43 and above</td>
<td>50</td>
</tr>
</tbody>
</table>

**Substantiation:** Many Flexible Cords and/or cables are listed in Tables 400-4 through 400-5 as having 2 or more conductors. The Ampacity rating described in Table 400-5 does not recognize cords/cables or more than 3 conductors.

**Panel Recommendation:** Accept as Revised.

**Vote on Panel Recommendation:** Unanimously Affirmative.

---

**Proposal:** 74 Amend the second paragraph as follows:

"Where a single conductor is used for both equipment ground "and" to carry unbalanced current from other conductors, as provided for in Sections 250-20 for electric clothes dryers and electric ranges, it "shall" be considered as a current carrying conductor."

**Substantiation:** A grounded conductor in my opinion should be considered as a current carrying conductor in the article. Simply because it does not carry a current. It carries the unbalanced current from the other conductors. It is essential in the starting and running of electric ranges and electric clothes dryers. It usually doesn't carry as much current as the phase conductors, but it does carry a certain amount of current.

**Panel Recommendation:** Reject.

**Vote on Panel Recommendation:** Unanimously Affirmative.

---

**Proposal:** 75 In the first sentence insert "copper" following "current-carrying"...

**Substantiation:** This proposal is submitted to clarify the proper conductor for the application. Makes clearer the fact that the grounding wire is to be copper. The panel is referred to the proposed revision in Section 110-5.

**Panel Recommendation:** Accept.

**Vote on Panel Recommendation:** Unanimously Affirmative.
Table 400-5: Reject CMP 6

SUBMITTER: R. Droste, National Elevator Industry, Inc.

PROPOSAL: 76 The table should be modified to Table 310-16 to 310-19 to show different ampacity ratings for conductors with rubber covered insulation compared to thermoplastic insulation. The table should also provide ampacity rating for size No. 20 AWG wire.

SUBSTANTIATION: Section 340-7 states that ampacities of a Type TC Ray Cab (multiple conductors) should be determined from Table 400-5, etc.

In Table 400-5 the rubber insulated conductors (temp. rating 60°F) have the same ampacity rating as thermoplastic conductors (temperature rating 90°C).

Table 400-5 does not cover size No. 20 AWG conductor. Table 400-4 does.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The Panel does not agree with the supporting comments.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

400-7(a) and (b): Reject CMP 6

SUBMITTER: Stephen D. Channer, Business and Institutional Furniture Manufacturers Assn., BIFMA

PROPOSAL: 77 Add the following to (a):

"or (d) connection of office furnishings, appliances and lighting as permitted by Sections 410-100, 410-101, and 410-102."

Revise (b) as follows:

Delete "and after (a)(6) and add "and (a)(10)" after (a)(8)."

SUBSTANTIATION: This proposal concerns itself with wiring systems as provided by members of our industry with office furniture systems that are now being used extensively in offices throughout the United States. Although not exclusively, office furniture systems are primarily used in areas referred to as "open plan" or "landscape" office layouts.

Within our industry, office furniture systems have grown in popularity to a great extent over the past several years. Much of the popularity stems from the advantages of portability and ease of rearrangement. Today the sales of this type of furniture are well over 300 million dollars annually and growing. Due to energy conservation requirements, users have demanded the inclusion of task and ambient lighting with this type of furniture. Current industry estimates show that approximately 80 percent of all office furniture systems sold contain electrical power. When such power is provided by manufacturers within our association, safety is foremost in the minds of us. Our purpose in submitting the enclosed proposal to the National Electrical Code is to establish a category within the National Electrical Code that deals specifically with products made within our industry that contain wiring systems and to provide in writing the standard of quality that must be adhered to by those making such systems.

Your review and favorable consideration of this proposal will be very much appreciated by the business and institutional furniture industry.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: CMP feels proposal is not in consonance with Section 400-5.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

400-7(c) (New): Reject CMP 6


PROPOSAL: 79 Add new (c) as follows:

"(c) Flexible cord connections may be made directly to the load end terminals of busway plug-in devices, provided such connections do not exceed cord tension taken at the load end terminals of busway plug-in devices."

"(d) Flexible conductors may be plugged into a conveniently located receptacle outlet at a convenient fixed location. In actual practice, appliances may have to be moved from place to place in locations where the only available power supply might be from a run of plug-in busway."

"For this application, strict interpretation of 400-7(b) requires the introduction of new terms or phrases to cover the introduction of flexible cord and the plug-in device."

1. Cord-to-busway connections are permitted per Section 364-8 but no guidelines are included for the make-up of such connections.

2. Proposed 400-7(c) satisfies the intent of 400-7(b); the busway plug-in device serves as the attachment plug-and the busway plug-in opening serves as the receptacle outlet.

3. Proposed 400-7(c) eliminates the unnecessary intermediate...
connection in the sequence: flexible cord—to attachment plug—to receptacle outlet—to load terminals of busway plug-in device—to plug-in jaws—to bus bars of busway.

**Panel Recommendation:** Reject.

**Vote on Panel Recommendation:**

- **Affirmative:** 8
- **Negative:** 4

**Explanation of Vote:**

**Coyle:** The proposal should be revised by changing “May” to “shall be permitted” in the first line. This is a safe and suitable manner of making connections to busway plug-in devices as explained in the substantiation, but it is not adequately covered in Section 364-8 as the Panel Comment claims.

**Jannet:** I disagree with the Panel Comment that the material is adequately covered in Section 364-8. The submitter has stated that the NEC now requires the complex arrangement detailed in Item 3 of his Substantiation. The consensus of the Panel was that this is not required and that cords can be — and are now — connected directly to the plug-in devices. Obviously, then, the NEC as it is now written is subject to misinterpretation and, in my opinion, accepting this proposal would clarify this point.

**Lipsy:** I do not agree with the Panel Comment that this material is properly covered by Section 364-8. The submitter, NEMA, states that the present Code requires the arrangement outlined in paragraph 3 of his Substantiation. The Panel felt that this is not required and that cords can and are now being connected directly to the plug-in devices. It appears that the Code, as now written, is being misunderstood. The acceptance of the proposal will clarify this.

**400-9: Reject**

**Submitter:** Idaho Chapter, IAEI

**Proposal:** Add a new section as follows:

- Flexible cords shall, where passing through holes in outlet boxes, covers or similar enclosures, be protected by approved bushings or fittings especially designed for the purpose.

**Substantiation:** Flexible cords or cables should be protected from sharp edges where they pass through holes in sheet metal covers or boxes. UL standards require a bushing or protection where passing through a sheet metal hole and this same protection should be given to field installed cords.

**Panel Recommendation:** Accept as Revised:

- **Add a new section as follows:**
  - 400-14. Protection from Damage. Flexible cords and cables shall be protected by bushings or fittings where passing through holes in covers, outlet boxes or similar enclosures.

**Vote on Panel Recommendation:**

- **Unanimously Affirmative:**

**400-10: Reject**

**Submitter:** Southwestern Section IAEI

**Proposal:** Add the following sentence to Section 400-10:

- Flexible cords shall, where passing through holes in outlet boxes, covers or similar enclosures, be protected by approved bushings or fittings especially designed for the purpose.

**Substantiation:** Flexible cords or cables should be protected from sharp edges where they pass through holes in sheet metal covers or boxes. UL standards require a bushing or protection where passing through a sheet metal hole and this same protection should be given to field installed cords.

**Panel Recommendation:** Reject.

**Vote on Panel Recommendation:**

- **Unanimously Affirmative:**

**400 Part C: Reject**

**Submitter:** TSC-Nominal Voltage

**Proposal:** 83 Delete the word “nominal” from heading.

**Substantiation:** Change recommended for clarification and to obtain conformance with present practice and uniformity within the Code.

**Panel Recommendation:** Reject.

**Vote on Panel Recommendation:** The present wording adequately reflects the Panel's intent.

**Vote on Panel Recommendation:**

- **Unanimously Affirmative:**

**400-31(a): Accept**

**Submitter:** Peter Pollak, The Aluminum Association

**Proposal:** 84 In the first sentence following "No. 8," insert “copper or No. 6 aluminum...”

**Substantiation:** The proposal requires the use of copper conductor for any and all applications. The size limitation is based upon an ampacity requirement which can be met with an aluminum conductor sized to provide the required ampacity. The panel is referred to the proposed revision in Section 110-5.

**Panel Recommendation:** Reject.

**Vote on Panel Recommendation:**

- **Unanimously Affirmative:**

**ARTICLE 402 -- FIXTURE WIRES**

**402-1: Accept**

**Submitter:** Secretary's Note: It was the action of the Correlating Committee that the panel review this Proposal for possible conflict with Table 402-3 which mentions other kinds of conductors.

**Proposal:** 86 Revise as follows:

- (a) Conductors shall be No. 8 AWG copper or larger and shall employ flexible stranding.

**Substantiation:** To clarify the proper conductor type for the application.

**Panel Recommendation:** Accept.

**Vote on Panel Recommendation:**

- **Unanimously Affirmative:**

**402-31(a): Accept**

**Submitter:** Peter Pollak, The Aluminum Association

**Proposal:** 89 Change the sentence to read as follows: This article covers general requirements and construction specifications for copper fixture wires.

**Substantiation:** This proposal is submitted to clarify the proper size equivalent of aluminum conductor for the application. Makes clearer the fact that the conductor is to be copper. The panel is referred to the proposed revision in Section 110-5.

**Panel Recommendation:** Accept.

**Vote on Panel Recommendation:**

- **Unanimously Affirmative:**

**110**
connection in the sequence: flexible cord-to attachment plug-to receptacle outlet—to load terminals of busway plug-in device—to plug-in jaws—to bus bars of busway.

**Panel Recommendation:** Reject.

**Panel Comment:** Material is adequately covered in Section 364-8.

**Vote on Panel Recommendation:**

**Affirmative:** 8

**Negative:** Coffey, Jannot, Lipsey.

**Explanation of Vote:**

**Conley:** The proposal should be revised by changing "May to "shall be permitted to" in the first line.

**Jannot:** I disagree with the Panel Comment that the material is adequately covered in Section 364-8. The submitter has stated that the NEC now requires the complex arrangement detailed in item 3 of his Substantiation. The consensus of the Panel was that this is not required and that cords can be -- and are now -- connected directly to the plug-in devices.

**Lipsey:** I do not agree with the Panel Comment that this material is properly covered by Section 364-8. The submitter, NEMA, states that the present Code requires the arrangement outlined in paragraph 3 of his Substantiation. The Panel felt that this is not required and that cords can and are now being connected directly to the plug-in devices. It appears that the Code, as now written is being misunderstood. The acceptance of the proposal will clarify this.

**400-9: Reject**

**Submitter:** Idaho Chapter, IAEI

**Proposal:** 80 In Section 400-9 the third line down change the words "hard-service" to "hard-usage."

**Substantiation:** This will make the wording here in 400-9 consistent with the wording in the Table 400-4. There will be no question of the type flexible cords that are permitted to be repaired after initial installation.

**Panel Recommendation:** Reject.

**Panel Comment:** The present wording adequately reflects the Panel's intent. The intent of Section 400-9 is to permit the splicing of hard-service cord only, such as Types S, SO, ST, and STO.

**Vote on Panel Recommendation:**

**Affirmative:** Hogan.

**Negative:** Coffey, Jannot, Lipsey.

**Explanation of Vote:**

**Conley:** I would change my vote on the proposal if the words "hard service flexible cords" were revised to read as follows: "flexible hard service cords." This would then pin down precisely what the panel says is intended and would also answer the proposer's aim.

**400-10: Accept**

**Submitter:** R. S. Pinkerton, Los Angeles, CA

**Proposal:** 81 Add a sentence as follows:

"Flexible cords shall, where passing through holes in outlet boxes, covers or similar enclosures, be protected by approved bushings or fittings especially designed for the purpose."

**Substantiation:** Flexible cords or cables should be protected from sharp edges where they pass through holes in sheet metal covers or boxes. UL standard require a bushing or protection where passing through a sheet metal hole and this same protection should be given to field installed cords.

**Panel Recommendation:** Accept as Revised.

**Add a new section as follows:**

400-16. Protection From Damage. Flexible cords and cables shall be protected by bushings or fittings where passing through holes in covers, outlet boxes or similar enclosures.

**Vote on Panel Recommendation:** Unanimously Affirmative.

**400-10: Reject**

**Submitter:** Southwestern Section IAEI

**Proposal:** 82 Add the following sentence to Section 400-10:

"Flexible cords shall, where passing through holes in outlet boxes, covers or similar enclosures, be protected by approved bushings or fittings especially designed for the purpose. UL standards require a bushing or protection where passing through a sheet metal hole and this same protection should be given to field installed cords."

**Panel Recommendation:** Reject.

**Panel Comment:** See panel action on Proposal No. 81, Section 400-10.

**Vote on Panel Recommendation:** Unanimously Affirmative.

**400 Part C: Reject**

**Submitter:** TSC-Nominal Voltage

**Proposal:** 83 Delete the words "nominal" from heading.

**Substantiation:** Change recommended for clarification and to obtain conformance with present practice and uniformity within the Code.

**Panel Recommendation:** Reject.

**Panel Comment:** The present wording adequately reflects the Panel's intent.

**Vote on Panel Recommendation:** Unanimously Affirmative.

**400-31(a): Reject**

**Submitter:** Peter Pollak, The Aluminum Association

**Proposal:** 85 In the first sentence following "No. 8" insert "copper or No. 6 aluminum....."

**Substantiation:** This is submitted to clarify the proper size equivalent of aluminum conductor for the application.

**Panel Recommendation:** Reject.

**Panel Comment:** See panel action on Proposal No. 84A, Section 400-31(a).

**Vote on Panel Recommendation:** Unanimously Affirmative.

**Article 402 -- Fixture Wires**

**402-1: Accept**

**Submitter:** CM 6

**Proposal:** 88A Revise as follows:

(a) Conductors shall be No. 8 AWG copper or larger and shall employ flexible stranding.

**Substantiation:** To clarify the proper conductor type for the application.

**Panel Recommendation:** Accept.

**Panel Comment:** "See panel action on Proposal No. 84A, Section 400-31(a)."

**Vote on Panel Recommendation:** Unanimously Affirmative.

**402-3:(a): Accept**

**Submitter:** CM 6

**Proposal:** 89 In Table 402-3, change the words "flexible hard service cable" to "flexible hard service cords."

**Substantiation:** Change recommended for clarification and to obtain conformance with present practice and uniformity within the Code.

**Panel Recommendation:** Accept.

**Vote on Panel Recommendation:** Unanimously Affirmative.

**402-16: Accept**

**Submitter:** CM 6

**Proposal:** 90A Change the sentence to read as follows: This Article covers general requirements and construction specifications for copper fixture wires.

**Substantiation:** This proposal is submitted to clarify the proper size equivalent of aluminum conductor for the application.

**Panel Recommendation:** Accept.

**Panel Comment:** The panel refers to the proposed revision in Section 110-5.

**Vote on Panel Recommendation:** Unanimously Affirmative.

**402-4: Unanimously Affirmative**

**Vote on Panel Recommendation:** Unanimously Affirmative.
SUBSTANTIATION: This proposal was accepted for inclusion in the 1978 NEC. The proposal was printed to show, therefore the printed version of the 1978 NEC does not correctly reflect the action of the Committee. Refer: Proposal No. 4 page 213 of 1978 Preprint NEC.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COFFEE: I suggest that when presenting this proposal in the preprint for public comment, that the entire third column of Table 402-3 for Type AF fixture wire be included.

Table 402-3: Accept

SUBMITTER: Cutter D. Palmer, Wilmington, DE

PROPOSAL: 98 Add fixture wire types KF-2 and KFF-2, revise Applications Provisions column to read: "Fixture wire, and as permitted in Sections 725-16 and 760-16. Limited to 300 volts."

For wire types KF-2 and KFF-2, revise Applications Provisions column to read: "Fixture wire, and as permitted in Sections 725-16 and 760-16."

SUBSTANTIATION: Multiple conductor type KFF-2 cable has been tested by Underwriters Laboratories in Northbrook, Illinois, in both the modified Steiner Tunnel Test and the IEEE-383 vertical tray test. In both tests full cable trays were subjected to flame. Flame spread and smoke values were the lowest of any cables previously tested. Enclosed is a copy of a letter from UL with these test results. Also enclosed is a copy of the UL Fact Finding Investigation which was the basis for listing these wire types in the 1978 NEC.

HUNDREDS of millions of feet of wire with the KF-2 insulation system have been used for approximately 10 years in commercial and military aircraft as well as the wiring for most space vehicles and missiles. For instance, each Lockheed L-1011 has approximately 650,000 feet of this wire installed as open-jacketed bundles, both in the fuselage and in the SWAMP (special wind and moisture problems) areas. The airlines report that HALAR insulated wire is recognized by the Electrical Trust of South Australia for 150°C 250V service and is therefore reciprocally recognized for use throughout Australia. In addition, the use of ECTFE as insulation for fixture wire will be substantiated by a Fact Finding Report by the Underwriters Laboratories. The investigation is underway with a preliminary report on the short term and 30 day aging expected by December 1st and the final report in late January.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 89, Table 402-3. Accept CMP 6 Proposal 89A and refer to CMP 16.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBSTANTIATION: See Proposal No. 89.

PANEL RECOMMENDATION: Accept contingent upon the concurrence of CMP 16.

PANEL COMMENT: See Panel action on Proposal No. 88, Table 402-3.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 402-3: Accept

SUBMITTER: Cutter Palmer, E. I. duPont de Nemours & Co., Inc., Wilmington, DE

PROPOSAL: 90 Add fixture wire Types KF-1, KF-2, KFF-1, KFF-2 to Table 402-3.

Table 402-3: CMP 6

PROPOSAL: CMP 6

PROPOSAL: 89A Amend Section 725-16(b) and 760-16(b) do not permitted to 300 volts. CMP 6 accepts second paragraph to revise "Applications Provisions" column for Types KF-2 and KFF-2.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 402-3: CMP 6

PROPOSAL: AKA Revise "Applications Provisions" column for Types KF-2 and KFF-2 to read: "Fixture wiring, and as permitted in Section 725-16." This language is permissive and does not restrict the use of fixture wires. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Recept.

PANEL COMMENT: See Panel action on Proposal No. 88, Table 402-3.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 402-3: CMP 6

SUBMITTER: Cutter Palmer, E. I. duPont de Nemours & Co., Inc., Wilmington, DE

PROPOSAL: CMP 6

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBSTANTIATION: Kapton Tape insulated wire has been used for several years in aircraft such as the L1011 and other military and government applications. Kapton's excellent electrical and mechanical properties, coupled with the ability to consistently apply the tape uniformly and concentrically over the conductor, results in reduced insulation thicknesses not possible with conventional extruded insulations.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 88, Table 402-3.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
402-11 Exception: Accept


PROPOSAL: 92 Revise as follows:

- Exception: As permitted by Section 725-16 for Class 1
circuits and Section 760-16 for fire protective signaling
circuits.
- SUBSTANTIATION: Table 402-3 (right hand column) permits this
for types of fixture wires covered in 760-16(b). In correlating
changes to the 1978 NEC, I believe the reference to 760-16 in
the Exception to 402-11 was left out in error.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

CHAPTER 9 -- TABLES AND EXAMPLES

Chapter 9, Tables 6, 7 and 8: Accept

SUBMITTER: Alton R. Thompson, Durham, NC

PROPOSAL: 93 Add to Tables 6, 7 and 8: “No. 8 stranded
conductors.”

SUBSTANTIATION: Since January 1973, No. 8 solid wire has been
removed from the National Electrical Code book to be installed
in conduit, except for Article 680. The properties of No. 8
stranded should be listed in Tables 6, 7 and 8.

PANEL RECOMMENDATION: Accept as Revised.

Table 6. Add “sol.” after existing “8” and add No. 8 stranded
dimensions as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B str.</td>
<td>.43 .148 .43 .75 .282 .86 .581</td>
</tr>
</tbody>
</table>

Revise Note as follows:

Note - No. 14 to No. 10, solid conductors; No. 8, solid or
stranded conductors; No. 6 and larger, stranded conductors.

Table 7. Add “sol.” after existing “8” and add No. 8 stranded
dimensions as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B str.</td>
<td>.325 .083 .285 .064 .390 .119</td>
</tr>
</tbody>
</table>

Revise Note as follows:

Note: No. 14 to No. 10, solid; No. 8, solid or stranded; No. 6
and larger, stranded; except AVL where all sizes are stranded.

Table 8. Add No. 8 stranded properties as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>16510 7 .0466 .1458 .0167 .653 .679 1.07</td>
</tr>
</tbody>
</table>

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 410 -- LIGHTING FIXTURES, LAMPHOLDERS, LAMPS, RECEPTACLES, AND ROSETTES

410-Editorial (HOD 1978 NEC): Accept

SUBMITTER: A. Knickrehm, Los Angeles, CA

PROPOSAL: 1 Amend Article 410 as follows:

1. (a) 410-65(a) Remove the words "constructed or...

2. (b) 410-65 Add new:

(c) Maximum Operating Temperature. Fixtures shall be so installed that the maximum operating temperature of the component parts of the fixtures will not be exceeded.

3. (c) 410-36 Add new third sentence:

Fixtures shall be so designed that the component parts of the fixtures will not exceed their maximum operating temperature when the fixtures are installed in compliance with this article.

4. (d) 410-68 Add new second sentence:

Fixtures shall be so constructed that the maximum operating temperature of their component parts will not be exceeded.

SUBSTANTIATION: To ensure that the maximum temperatures of fixture parts are not exceeded. Fixtures are sometimes boxed in by fire resistant materials to comply with fire and building codes. This causes excessive temperatures to fixture parts, such as "P" rated lamp ballasts. When it is required to box-in fixtures suitable low heat equipment is available for fixture construction.

PANEL RECOMMENDATION: Accept as Revised.

Accept the item (I.) portion of the proposal by deleting the words "constructed or.." from Section 410-65(a).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Article 410: Accept

SUBMITTER: CMP 21

PROPOSAL: 1A Amend Article 410 as follows:

1. (a) 410-19. Make existing first sentence of first paragraph (a); relocate balance of first paragraph; all of paragraph two and four to new 410-30(c). Relocate third paragraph to new 410-16(g).

2. (b) 410-23. Relocate text to (b) of 410-24.

3. (c) 410-24. Change heading to "Conductors;" make existing text (a) with title "Insulation." Delete present (b).

4. (d) 410-26. Delete heading; relocate 410-26(a) to new 410-28(e) with title "Insulation." Delete present (b).

5. (e) 410-28. Relocate 410-28(c) to new 410-30(a). Change title to "Cord connected lampholders and fixtures."

6. (f) 410-29. Relocate 410-29(e) to 410-57(b) and change 410-57(b) to (c); (c) to (d); (d) to (e).

7. (g) 410-30. Change heading to "Cord connected lampholders and fixtures."

8. (h) 410-30(a) to new 410-16(b).

9. (i) 410-30(b) to new 410-29(c).

10. (j) 410-30(c) to new 410-29(d).

11. (k) 410-30(d) to new 410-14(b).


13. (m) 410-40. Relocate to new 410-16(d).

14. (n) 410-41. Relocate to new 410-16(e).

15. (o) 410-77. Delete the words "constructed or.." from Section 410-29(e) and revise to read: Where show cases are cord connected, the secondary circuit(s) of discharge lighting shall be limited to one show case. Change 410-77(c) to 410-77(b).

SUBSTANTIATION: Arranged to place requirements of the same subject in the same sections.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-X: Reject

SUBMITTER: C. Muhleman, MarlON IN

PROPOSAL: 3 Add new sections to Article 410 Part A as follows:

14. (a) 410-overcurrent. Each fixture shall have overcurrent protection built into the fixture or its cord cap. The overcurrent device shall not exceed 150 percent of the fixture load.

15. (b) 410-temperature. Each recessed fixture shall have overtemperature protection built into the fixture.

16. (c) 410-location. A permanent lighting fixture shall be installed in each room or space into which a person can enter.

PANEL COMMENT: Residential living rooms.

SUBSTANTIATION: Proposed "overcurrent" should prevent small faults from not being detected by a large overcurrent device and thus will reduce fires.

Proposed "Overtemperature" should prevent fires from overtemperatures such as may be caused from installing thermal insulation around the fixture.

Proposed "Location" will eliminate some of the need for extension cords, etc., which have attributed to many electrocutions.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-4(a): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 4 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-4(c)(1): Reject

SUBMITTER: Jim Fleschman, Boise, ID

PROPOSAL: 6 Revise as follows:

(1) The fixture noted "approved" shall be an approved assembly and so installed that the temperature limits of the materials used are not exceeded.

SUBSTANTIATION: We are having problems where lights are listed and labeled and are not properly installed as a complete assembly. The hood and lights should be tested and approved to meet Section 410-4 and Section 300-22(a).

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: In re-evaluating this proposal, the CMP cannot justify a lamp location fixture to be required in all areas of a bathroom.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-4(c)(1): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 6 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-4(c)(5) (New): Reject

SUBMITTER: Idaho Chapter IAEI Boise, ID

PROPOSAL: 7 When fire extinguishing equipment is required, the energy supply to the appliance shall be simultaneously interrupted upon actuation of the extinguishing system.

SUBSTANTIATION: To coordinate with NFPA 17 4-4.1 the amended addition will reduce fire hazards which would result from overheated appliances when extinguishing chemical is expended.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-8: Reject.

PANEL COMMENT: Proposal is not within the scope of Article 410. CMP 21 conferred with CMP 10 and there was a lack of support for the Proposal.

VOTE ON PANEL RECOMMENDATION: AFFIRMATIVE: 8.
NEGATIVE: 0.

EXPLANATION OF VOTE:
WELLS: I concur with the fact that this proposal is not within the scope of Article 410. I disagree with the statement that there was a lack of support for the proposal from Panel. For the record, I cite the comments of Panel 10 members in their vote following the December, 1978 Panel meeting.

"Erickson: In its present form the proposal cannot be inserted in Article 422. I believe the proposal has merit and would like to see it reworked for Article 422.

"Mazzoni: In my view the proposal is not in keeping with the NEC. We cannot legitimately object to the installation of fixtures without a building permit. Homeowners are not familiar with the NEC. We can say that a bathroom is a wet or damp location.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-8: Reject.

SUBMITTER: Allen Knickrehm Los Angeles Chapter, NECA PROPOSAL: 9 Move the material in Section 410-8 regarding fixtures in clothes closets, to a new Section 210-27 titled: "Clothes Closet Lighting Only and not otherwise permitted."

SUBSTANTIATION: Article 410 is very careful in defining the proper methods for installing fixtures in clothes closets. The same attention is required for fixtures in bathrooms. There is an increasing trend toward the installation of fixtures, chandeliers, swag lamps and pendants over bathtubs, thereby creating an extreme hazard.

"We cannot legislate against the installation of fans over fixtures, because it is not specifically prohibited by NEC. We cannot say that a bathroom is a wet or damp location.

PANEL RECOMMENDATION: Accept as Revised.

(4) Pendants. Hanging fixtures and pendants shall be so installed that the fixture is not less than 8 feet above the top of the bathtub.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-8: Reject.

SUBMITTER: Fred Mays, Albuquerque, NM PROPOSAL: 8 Add now (d) as follows:

(4) Fixtures in Bathrooms:

(1) A fixture in a bathroom shall be on a circuit protected by a ground-fault circuit-interupter.

(2) Hanging fixtures and pendants shall not be permitted directly above bathtubs, unless approved for damp or wet locations, and shall be marked, "suitable for Damp Locations."

SUBSTANTIATION: Article 410 is very careful in defining the proper methods for installing fixtures in clothes closets. The same attention is required for fixtures in bathrooms. There is an increasing trend toward the installation of fixtures, chandeliers, swag lamps and pendants over bathtubs, thereby creating an extreme hazard.

"We cannot legislate against the installation of fans over fixtures, because it is not specifically prohibited by NEC. We cannot say that a bathroom is a wet or damp location.

PANEL RECOMMENDATION: Accept as Revised.

(4) Pendants. Hanging fixtures and pendants shall be so installed that the fixture is not less than 8 feet above the top of the bathtub.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-8: Reject.

SUBMITTER: S. B. Koonz, Chesapeake Chapter IAEI PROPOSAL: 10 Revise title as follows:

410-8: Incandescent Fixtures in Clothes Closets.

SUBSTANTIATION: The biggest fire hazard seems to be the surface temperature of the incandescent bulb and hot particles of metal falling onto clothes. Since incandescent bulbs have a surface temperature in the range of 500°F., and when broken will drop hot particles, there would seem to be a danger that these fixtures should be considered. By clarifying that it is only incandescent, it would allow fluorescent fixtures to be used, as they have always been identified as "cold" lighting, and can even be touched after being on for long periods of time. This would help some areas of the country where the main concern of fixtures installed in clothes closets is to provide lighting only and not to provide any drying effect, as in some areas of the country where incandescent fixtures are used.

PANEL RECOMMENDATION: Accept as Revised.


410-8: Reject.

SUBMITTER: Richard P. Kuchnicki, National Association of Home Builders (NAHB) PROPOSAL: 11 Revise as follows:


(a) Location. A fixture in a clothes closet shall be permitted to be installed: (1) on the wall above the closet door, provided the clearance between the fixture and a storage area where combustible material may be stored within the closet is not less than 18 inches or is protected in accordance with Section 410-5 and (2) on the ceiling over an area which is unobstructed to the floor maintaining a 18-inch clearance horizontally between the fixture and a storage area where combustible material may be stored within the closet. If the fixture is protected in accordance with Section 410-5, the 18 inch clearance is not required.

A flushed recessed fixture equipped with a solid lens shall be considered outside the closet area.

SUBSTANTIATION: The Code requirement is in contradiction with Section 410-5. If a fixture is protected in accordance with 410-5, the 18 inch clearance should not be necessary. Many builders are forced to use recessed fixtures in closets because it is impossible to maintain the 18 inch clearance. Numerous fires have been reported due to recessed fixtures coming in contact with improperly manufactured cellular insulation. Even though Section 410-66 regulates insulation around recessed fixtures, it is impossible to enforce this regulation since insulation is added by the homeowner usually without a building permit. Homeowners are not familiar with the NEC.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 13, Section 410-8(a)(2).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.


SUBMITTER: TSC-Approved for the Purpose PROPOSAL: 12 Add new exception as follows:

Exception: Fluorescent fixtures shall not be permitted to be installed on the wall above the closet door.

SUBSTANTIATION: Many new homeowners and builders wish to have closet lights and with the restrictions of thermal insulation near recessed fixtures, the Code makes it almost impossible to install recessed closet lights in second floor bedroom closets. There would be no hazard involved if the Code permitted a two-foot fluorescent strip light above the closet door where the surface temperature of the tube is too hot and it is in a properly protected area.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 13, Section 410-8(a)(2).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.


SUBMITTER: Clyde H. Craig, Toledo Chapter NECA PROPOSAL: 13 Change last sentence of paragraph (2) to read:

A glass enclosed surface fixture, recessed fixture with a solid lens or fluorescent fixture may be permitted there is a 6-inch clearance horizontally between the fixture and the storage area.

SUBSTANTIATION: Most closets in homes are 24 inches deep, making it impossible to install anything but recessed fixtures. Under today's insulation standards, it's not practical to install recessed fixtures in second floor closets. The 18 inch requirement is too severe.

PANEL RECOMMENDATION: Accept as Revised.

PANEL COMMENT: Change the second paragraph as follows: A flush recessed fixture with a solid lens, or a ceiling-mounted fluorescent fixture shall be permitted to be installed provided there is a 6-inch clearance, horizontally, between the fixture and the storage area.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-11: Accept.

SUBMITTER: TSC-Approved for the Purpose PROPOSAL: 14 See the Technical Subcommittee "Recommendations" under the definition of "Approved For the Purpose" in Article 410.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved For the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

PANEL COMMENT: Delete "approved for the purpose" and replace with "identified for through wiring."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-11, Exception-(New): Reject.

SUBMITTER: Arnold W. Rodin, American Home Lighting Institute PROPOSAL: 15 Add the following exception:

Exception: Branch circuit conductors having insulation suitable for at least 90°C (194°F) shall be used for wiring of
all ceiling outlet boxes on which a lighting fixture is, or may be, mounted. The ampacity of 60°C wire shall be limited to the ampacity of 90°C wire.

SUBSTANTIATION: With the advent of energy conservation, thermal insulation is being used more and more to combat winter heat losses and summer heat gains in buildings. As a result, new construction, especially home construction, is being fitted with greater amounts of thermal insulation. In most instances, electrical outlet boxes in which surface ceiling incandescent fixtures are attached and junction boxes supplying power to recessed fixtures are entrenched in a heavy concentration of thermal insulation. This can lead to heat buildup in the outlet boxes which may exceed safe values. Higher temperatures are likely to destroy the insulation wiring in the boxes, resulting in shock hazard, short circuits and fire. The condition may be further compounded when the consumer chooses to disguise the fixture wiring by maximum coverings and installs higher wattage lamps. In order to reduce the hazards that can be created by higher temperatures in ceiling outlet boxes, we request that branch circuit conductors having insulation suitable for at least 90°C (194°F) be used for wiring of all ceiling outlet boxes on which a lighting fixture is, or may be, mounted. Many of the fixture-attached-cord does not exceed 6 feet.

SUBSTANTIATION: The word "suspend" cord-equipped fixtures directly below the outlet box is word choice implying that the cord and outlet box support the weight of the fixture. The words "if the cord is continuously visible for its entire length" has absolutely nothing to do with safety to either persons or property, unless someone wants to devote their lifetime to watching the cord. This section of Code has been functionally massaged in past Code revisions. This is an earnest attempt to resolve the issue.

UL has accepted and listed electric-discharge lighting fixture connections for suspended ceilings consisting of wiring in flexible metal tubing terminating in an approved grounding plug (cap). With over 1,500,000 fixture-years, of trouble free service, and with fixture maintenance given by the time the time of installation. I believe this should be clarified.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

WELLS: The words "in a lay in suspended ceiling where the ceiling panels would be, mounted. The ampacity of 90°C wire shall be limited to the ampacity of 60°C wire (140°F)."

SUBSTANTIATION: The Uniform Building Code requires that suspended ceilings be adequately supported. This is usually in the form of an iron wire support attached to the structural ceiling members and the other end of the wire attached to the suspended ceiling frame. The lighting fixtures are then laid in the openings and secured only by light metal clips. There have been numerous accidents occur when these metal clips have been dislodged causing fixtures to fall to the floor. There have been many instances, where fixtures are installed in end-to-end rows, when one fixture becomes dislodged from construction vibration causing the entire row to also fall to the floor. There is also the danger of fixtures being shaken loose by severe disturbances due to earthquakes, and fire. The framing members distort and cause the fixtures to fall through the openings.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-14: Accept


PROPOSAL: Revise the second sentence as follows: Fixtures so mounted, bolts, screws, or rivets to the ceiling framing member. PANEL RECOMMENDATION: Accept.

410-14: Reject

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 10 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: Hence, I believe this should be clarified.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

WELLS: Since there are listed clips for this purpose it seems to me they should be recognized. I suggest adding "...screws, clips identified for the purpose, and rivets."
410-18(a): Reject

PROPOSAL: Add the words "environmental conditions" after (b) as follows:

LICURSI: TSC-Approved for the Purpose

SUBMITTER: Cynthia A. Knowlton, Columbus, OH

PANEL RECOMMENDATION: Accept as Revised:

EXPLANATION OF VOTE:

LICURSI: See Comment on Proposal No. 19.

410-20(Mew): Accept

SUBMITTER: Allen Knickrehm, Los Angeles, CA

PROPOSAL: Add section as follows:

LICURSI: TSC-Approved for the Purpose

SUBMITTER: H. B. Love/B. L. Auger, Michigan Chapter IAEI

PANEL RECOMMENDATION: Accept as Revised:

EXPLANATION OF VOTE:

LICURSI: See Comment on Proposal No. 22A.

410-24: Accept

SUBMITTER: CMP 21

PROPOSAL: Add the words "environmental conditions" after (b) as follows:

LICURSI: TSC-Approved for the Purpose

SUBMITTER: Clyde H. Craig, Toledo Chapter NECA

PANEL RECOMMENDATION: Unanimously Affirmative.

410-41: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

EXPLANATION OF VOTE:

LICURSI: A negative vote was cast on the Panel Recommendation because experience has proven that many pendant and chain-hung fixtures are installed in bathrooms on branch circuits not supplied with a grounding conductor. I cannot conscientiously ignore the impact a warning label on the fixture would have toward eliminating this very unsafe practice.
where flammable material may be present.

Panel Recommendation: Accept as Revised.

Ball cord shall be nonflammable, or chain portion shall extend a minimum of 7 inches from the lanyholder.


Negative: 5.

Explanation of Vote:

Short: There is no evidence of a problem. Not a single case has been reported to the concerned manufacturers involving accidents of this type.

410-56(f)-(New): Reject

Submitter: R. C. Cressman, General Electric Co.

Proposal: 28 Add new (a) and existing (a) becomes (b), etc.

(a) Receptacles, cord connectors, and attachment plugs rated 15 and 20 amperes and intended for use with connection to portable cords shall be approved for the use intended (not hard usage, hard usage, extra hard usage).

Substantiation: The Code presently recognizes in Table 400-4 three types of usages for portable cords (not hard usage, hard usage, extra hard usage). The design intended for use with these cords should be similarly recognized. The attachment plug, connector and receptacle receive abuse similar to that of cords. Plugs and connectors are subject to the same crushing forces as portable cords. Plugs, connectors, and receptacles can be damaged by abrupt removals, even more so than the cord.

The requirements for attachment, as for cord, connector, and attachment plug for use in the home on AWG 18 SPI are quite different from those used in heavy industry on AWG 18 50.

Definitions of use difference have been made by NEMA (WD1-1974, Part 3-General Duty and Heavy Duty), the Federal Government (NC5996-E), the International Electrotechnical Commission (Household Use and Industrial Use), and by UL 498 (Regular and Hospital Grade). The recognition by the Code of two usage differences would give guidance to UL to develop requirements to meet the needs of the user as they have done in flexible cords.

It would also serve as a basis for a single standard eliminating the duplication now being done by the various agencies.

Panel Recommendation: Reject.

Panel Comment: Supporting comment is not persuasive as to necessity.

Vote on Panel Recommendation: Unanimously Affirmative.

410-56(g)-(New): Accept

Submitter: Ted Steph, Step-Ellc Corp.

Proposal: 29 Add a new exception as follows:

Exception: A metallic faceplate of ferrous metals which is stamped in one piece and having a recessed center section of sufficient area to effectively seal a standard device box shall have a thickness not less than 0.020 inch.

Substantiation: A faceplate with a recessed center is by far many times more rigid than any flat faceplate. We therefore feel that the thickness of the metal can be reduced from 0.030 to 0.020 inches without giving up a large amount of strength, because of the internal bends in the center of the faceplate.

Panel Recommendation: Reject.

Panel Comment: The Panel does not agree with the supporting comment.

Vote on Panel Recommendation: Unanimously Affirmative.

410-56(h)-Exception-(New): Reject

Submitter: E. E. Carlson, Menlo Park, CA

Proposal: 32 Revise the second sentence as follows:

"Faceplates shall be installed so as to completely cover the wall or plug and seat against the wall surface."

Substantiation: To provide safety and prevent access to exposed live metal parts. This is an accepted practice and should be added to the Code. The same requirement presently is included in Section 300-9 for switches. Addition of this proposal to 410-56(h) will provide safety for receptacle outlet installations also.

Panel Recommendation: Accept as Revised.

Delete the word "wall" before the word "opening." Delete the word "wall" before the word "surface" and replace with "mounting." To read as follows:

"Faceplates shall be installed so as to completely cover the opening and seat against the mounting surface."

Panel Comment: CMP 21 feels that there are times when covers are required to seat against surfaces other than "walls" such as gaskets or surface-mounted boxes.

Vote on Panel Recommendation: Unanimously Affirmative.
410-57(b): Exception: Reject
SUBMITTER: R. C. Medley, Square D Co.
PROPOSAL: 38 Delete the words "self-closing."

SUBSTANTIATION: The reason for the request to remove "self-closing" rests with the UL based upon these words that any cover which required user assistance will no longer be acceptable for such use effective January 1, 1979, as covered by UL 514-C dated November 3, 1977, Paragraph 10.5. It states: "A cover with a detent or other feature designed to hold it open is not to be assisted in closing."

Unfortunately, the proposal prohibits a feature which is of importance to the users of cover plates. Such plates are typically used for switches as well as temporarily connected receptacles. A hold-open feature permits the user to open the lid and then insert or remove a plug (or operate a switch) allowing one hand operation. It also permits one hand closing with equal ease.

Such covers have been successfully used for over 15 years without incident. A hold-open feature is also of necessity to rounding type receptacles, cord connectors and weatherproof covers marked "Wet Location with Covers Closed" with equal ease.

It may be convenient for one-handed operation to have a cover stay open, it is also convenient for a user to fail to close the cover thus defeating the very purpose of the cover in the first place. Further, covers with hold-open features expose the cover to physical abuse which may prevent their future effective use.

410-58(a)(HOD 1978 NEC): Reject
SUBMITTER: John M. Wall, Central Calif. Chapter, Fresno, CA
PROPOSAL: 36 Amend Section 410-58(a) to read:
(a) Grounding type receptacles, cord connectors and attachment plugs shall be provided with one fixed grounding pole in addition to the circuit poles and shall be polarized when of the 2 parallel slot and blade configuration.

SUBSTANTIATION: There is a built-in safety feature in the grounding type receptacles in the form of a wider slot and associated terminal for the grounded circuit conductor and a narrower slot for the phase or hot circuit conductor and termination of the parallel slot 15 amperes 125 volt configuration. This feature provides safety whereby a 2 wire parallel polarized blade attachment plug and identified conductors and appliances may be used with a better degree of safety.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: No significant contribution to safety would result.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

AFFIRMATIVE: R. C. Medley, R. H. Knickrehm.
NEGATIVE: Licursi.
COMMENT ON VOTE: Wells: The present wording in 410-42 will require polarized plugs on portable lamps January 1, 1980. Nothing in the substantiation justifies requiring polarized plugs on two wire clocks, appliances, double insulated, etc. Such appliances are not portable. Knickrehm: The need to cover rosettes in the 1981 Code has disappeared with the dinosaur.

EXPLANATION OF VOTE: LICURSI: A negative vote was cast on the Panel Recommendation because with the requirement of 410-42(a) becoming effective January 1, 1990, there is no requirement in the Code that will provide a polarized receptacle for a two-wire polarized portable lamp.

410-58(a), Exception: Reject
SUBMITTER: Secretary's Note: It was the action of the Correlating Committee that correlation may be necessary with Proposal Nos. 50 and 52 of Code-Making Panel 5.

SUBMITTER: John L. Bennett, Power Tool Institute
PROPOSAL: 37 Delete the exception.

SUBSTANTIATION: This Exception anticipates the connection of a tool or appliance to either a receptacle with a grounding pole or to a two pole receptacle without a grounding pole. The availability of grounded receptacles has increased to the point that there is very little advantage in the use of plugs with movable grounding pole. The installation of grounded receptacles or fixed adapters should be encouraged. There is no apparent need to condone the ungrounded use of a tool or appliance which is not required to be grounded.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Supporting comment is not persuasive as to necessity.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-58(b)(4): Reject
SUBMITTER: F. K. Kitzantas, NEMA
PROPOSAL: 38 Revise as follows:
(a) If the terminal for the equipment grounding conductor is not visible, or if terminal screw is removable, the conductor entrance hole or the area adjacent to the terminal shall be marked with the word "green" or the symbol "\" or otherwise identified by a distinctive green color.

SUBSTANTIATION: The ground symbol "\" is an international means of identifying a ground. It is used in electric drawings and schematic diagrams. A symbol is used to transmit a message in a clear understandable manner independent of any language.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The proposal to use a ground symbol to identify a grounding terminal would not, in the CMP's opinion, further the cause of electrical safety. The proposal to use a grounding symbol in lieu of the '78 NEC is unacceptable since it would increase the probability of miswiring of the device.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

AFFIRMATIVE: B. Negative: K. Kitzantas.

COMMENT ON VOTE: Wells: The grounding symbol is unknown to millions of consumers who wire devices. Coloring the terminal provides color identification with the green wire. Using a technical symbol on a product which can be wired by a broad spectrum of non-technical users is, in my opinion, wrong.

EXPLANATION OF VOTE: Knickrehm: This use of graphics to overcome language and color barriers is internationally accepted. The NEC should also accept this fact.

410-58(c): Accept
SUBMITTER: Nathaniel J. Addleman, Wichita, KS
PROPOSAL: 39 Add a sentence as follows: Grounding type attachment plugs shall not be installed without a ground connection being made between the appliance and the grounding terminal of the plug.

SUBSTANTIATION: At present there seems to be no explicit prohibition against installing a grounding type attachment plug on an electrical cord without a grounding conductor. Such an installation could lead to the erroneous conclusion that the appliance that has a "two wire cord" connected to a "three prong plug" means that the appliance to which it is connected (via the power cord) is grounded.

Section 410-58(c) is not explicit enough to prohibit the above misleading use of a grounding type attachment plug.

PANEL RECOMMENDATION: Accept as Revised.

HOD POS'XL-38 Revise as follows:
(a) Use. Grounding-type attachment plugs shall be used only where an equipment ground is to be provided.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Article 410, Part M: Reject
SUBMITTER: Warren Anderson, Mount Vernon, WA
PROPOSAL: 40 Delete Paragraph 30. Rosettes

SUBSTANTIATION: The need to cover rosettes in the 1981 Code has disappeared with the dinosaur.

PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-64: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 41 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

HOD POS'XL-39 Delete the words "of a type approved for the purpose and shall" and replace with "identified for such installation."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-64(a)-(New): Accept
SUBMITTER: R. E. Ward, Tenn. Chapter, IAEI
PROPOSAL: 42 Add a sentence as follows:
(a) Recessed or surface mounted incandescent fixtures installed indoors adjacent or on combustible materials shall have thermal protection integral with the lampholders.

Exception: Fixtures with miniature intermediate lampholders.

SUBSTANTIATION: Fires are being caused under present Code rules applicable to over-clamping or misfit of insulating materials and such materials on or in the vicinity of electrical equipment. This proposal, if enacted, will give protection from this type hazard.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COMMENT ON VOTE:
Wells: I vote affirmatively because I believe the magnitude of the problem, in part demonstrated by the many proposals from manufacturers and distributors of such fixtures, mandates action. Subsequent to the Panel Meeting, I have been informed of a patent which might directly affect "integral protection of lampholders" and I believe the Panel, in its next meeting must revise the wording so as to allow other equally effective means of protection.

EXPLANATION OF VOTE:
Duffy: I am voting negative on the proposal because it includes surface-mounted units. Surface-mounted incandescent fixtures labeled by Underwriters Laboratories since August of 1978 have been tested and found acceptable for use on insulated ceilings. These fixtures are identified by the letters IC (Insulated Ceiling). Also, I believe the technical complexity of having the thermal protection integral with the lampholder is impractical. I would support the proposal with the deletion of "surface mounted" and I believe the requirement of integral lampholder thermal protection and replacement of such lampholders should be deleted.

SHORT: The proposal should be altered to call for the fixture itself to have thermal protection rather than singling out the lampholder within the fixture. This would permit UL, in their examination listing, to determine the hottest point of the fixture under an abnormal temperature test and that the thermal protection within the fixture would be such as to control the maximum temperature of that particular point of the fixture.

410-66: Reject

SUBMITTER: Murray Feiss, American Home Lighting Institute

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 42.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-66: Reject

SUBMITTER: Arnold W. Rodin, American Home Lighting Institute

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 42.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-66: Reject

SUBMITTER: Harry W. Rothenberg, Timely Lighting

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 42.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-66: Reject

SUBMITTER: Ronald C. Zaker, Halo Lighting

PROPOSAL: 46 Add new sentence as follows: Retrofit thermal insulation installed in ceilings that contain recessed fixtures, shall be inspected, including retrofit installations.

SUBSTANTIATION: Thermal insulation is being added to ceilings after recessed fixture installations have been inspected. This normally occurs at the termination of the building construction or at a later date after the building is occupied as a retrofit installation. In order to assure compliance with Section 410-66, both installation types should be inspected.

The absence of the requirement for such inspection constitutes a potential fire hazard.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 42.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
is normally referred to as a retrofit installation. In order to assure compliance with Section 410-66, the installation should be inspected.

The absence of the requirement for such inspection constitutes a potential fire hazard.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 42.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

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**410-66:** Reject

**SUBMITTER:** Jim Wiederhold, Corbett Lighting, Inc.

**PROPOSAL:**

52 Add new sentence as follows:

Retrofit thermal insulation installed in ceilings that contain recessed fixtures, shall be inspected.

SUBSTANTIATION: In many instances thermal insulation is added to ceilings after recessed fixtures have been inspected. This is normally referred to as a retrofit installation. In order to assure compliance with Section 410-66, the installation should be inspected.

The absence of the requirement for such inspection constitutes a potential fire hazard.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 42.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

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**410-66:** Reject

**SUBMITTER:** Irwin Goldberg, Coronet Chandelier Originals

**PROPOSAL:**

54 Add new sentence as follows:

Retrofit thermal insulation installed in ceilings that contain recessed fixtures, shall be inspected.

SUBSTANTIATION: In many instances thermal insulation is added to ceilings after recessed fixtures have been inspected. This is normally referred to as a retrofit installation. In order to assure compliance with Section 410-66, the installation should be inspected.

The absence of the requirement for such inspection constitutes a potential fire hazard.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 42.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

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**410-66:** Reject

**SUBMITTER:** O. E. Dillon, Border County Div. IAEI

**PROPOSAL:**

55 Revise second sentence as follows:

Recessed fixture enclosures, wiring compartments or ballasts shall not be installed within three inches of thermal insulation or in such a location so that heat is entrapped and free circulation of air is prevented except when the fixture is listed for the use.

SUBSTANTIATION: This section is practically unenforceable as the electrical inspector does not inspect or control the installation of thermal insulation. The use of the words "combustible material" without a definition of combustible material renders the sentence legally unenforceable. See the attached opinion of the San Diego City Attorney.

*See Border County Div. IAEI substantiation for proposal for 110-16(a)

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 42.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

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**410-66:** Reject

**SUBMITTER:** Julian Chacon, Lightcraft of California

**PROPOSAL:**

56 Add new sentence as follows:

Retrofit thermal insulation installed in ceilings that contain recessed fixtures, shall be inspected.

SUBSTANTIATION: In many instances thermal insulation is added to ceilings after recessed fixtures have been inspected. This is normally referred to as a retrofit installation. In order to assure compliance with Section 410-66, the installation should be inspected.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 42.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

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**410-66:** Reject

**SUBMITTER:** Reynolds K. Oehl, Santa Fe Springs, CA

**PROPOSAL:**

57 The following additional sentence should be added to Section 410-66:

Retrofit thermal insulation installed in ceilings that contain recessed fixtures shall be inspected.

SUBSTANTIATION: In many instances thermal insulation is added to ceilings after recessed fixtures have been inspected. This is normally referred to as a retrofit installation. In order to assure compliance with Section 410-66, the installation should be inspected. The absence of the requirements for such inspection constitutes a potential fire hazard.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See Panel action on Proposal No. 42.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.
410-72: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 61 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: The present wording adequately reflects the provisions of the NEC when they are written in this fashion.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-73(b): Accept

SUBMITTER: CMP 21

PROPOSAL: 62 Change "supply" to "circuit."

SUBSTANTIATION: For the sake of uniformity in terminology consistent with recommendations being made by the TSC for usage throughout the Code.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-73(e), Exception: Reject

SUBMITTER: CMP 21

PROPOSAL: 63A Add (f) as follows:

(f) Where recessed high-intensity discharge fixtures with integral ballast are installed indoors, the ballasts shall have thermal protection integral within the ballast. Replacements for these ballasts shall also be integrally protected.

Exception: This requirement shall become effective January 1, 1982.

SUBSTANTIATION: CMP 21 extends the same protection to provide for recessed high-intensity discharge fixtures that is now applied to fluorescent fixtures.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

410-73(f)-(New): Accept

SUBMITTER: CMP 21

PROPOSAL: 63A Add (f) as follows:

(f) Where recessed high-intensity discharge fixtures with integral ballast are installed indoors, the ballasts shall have integral protection integral within the ballast. Replacements for these ballasts shall also be integrally protected.

Exception: This requirement shall become effective January 1, 1982.

SUBSTANTIATION: CMP 21 extends the same protection to provide for recessed high-intensity discharge fixtures that is now applied to fluorescent fixtures.

VOTE ON PANEL RECOMMENDATION: As Revised.

COMMENT ON VOTE:

DUPPY: Although I am voting affirmative I believe further consideration of the effective date may be necessary to allow time for development and implementation of the protection program.

WELLS: See Comment on Proposal No. 42.

EXPLANATION OF VOTE:

SHUFF: This requirement is unnecessary because HID ballasts fall in a low resistance mode which results in blowing of fuses or tripping of circuit breakers whereas fluorescent ballasts fall in a high resistance mode.

410-75(b): Reject

SUBMITTER: Norman B. Cooney, Parma, OH

PROPOSAL: 64 Revise Section 410-75(b) as follows:

"Equipment exceeding 300V may be installed in dwelling occupancies if the design prevents exposed live parts.

SUBSTANTIATION: These sections are so confusing I don't believe an explanation is possible. You can, you can't, you can, which is it? Can you or can't you?

I would think somewhere in this morass of perplexity that someone would correlate the different CMP's and come up with a visible solution to this absurdity.

How can someone be expected to intelligently enforce provisions of the NEC when they are written in this fashion?

Simplicity in articles and words should be the byword of the NEC, not the confusion that is usually expressed.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
the cord length shall not exceed 8 feet.

c) Receptacle. Portable receptacle outlets shall not be permitted in lighting accessories.

410-112. Fixed Type. Wired partitions that are fixed (secured to building surfaces) shall be permanently connected to the building electrical system by one of the wiring methods of Chapter 3.

410-115. Free-Standing Type. Portions of the free-standing type (not fixed) shall be permitted to be permanently connected to the building electrical system by one of the wiring methods of Chapter 3.

Individual partitions of the free-standing type, or groups of not more than six individual partitions which are mechanically contiguous, shall be permitted to be connected to the building electrical system by a single flexible cord and plug provided all of the following conditions are met.

(a) Cord Type. The flexible power-supply cord shall be extra-hard usage or hard usage type with No. 12 AWG or larger conductors with a green grounding conductor and not exceeding 10 inches in length.

(b) Supply Receptacle. The receptacle supplying power shall be located not more than 12 inches from the partition which is connected to it. The receptacle supplying groups of partitions shall be on a separate circuit serving no other loads.

(c) Multiwire Circuits. Individual partitions, or groups of individual partitions where connected together, shall not contain multiwire circuits.

(d) Number of Receptacle Outlets. Individual partitions, or groups of interconnected individual partitions, shall not contain more than thirteen 15-ampere 125-volt receptacle outlets.

PANEL COMMENT: This Panel Proposal recognizes the existence of wired partitions for offices, schools and other applications and establishes rules concerning the construction and installation of the electrical system within and feeding these partitions. This type of equipment contains receptacles and lighting equipment and is, in the Panel's opinion similar to showcases which are within the scope of Article 410 and covered in Section 410-29. Section 410-29 serves as a source for many of the proposed requirements.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: B

NEGATIVE: KINCKREHM.

COMMENT ON VOTE:

WELLS: I support the Panel Recommendation and point out that subsequent to the meeting, I have become aware of some Panels with no flexibility between panels. The Panel should review 410-108 in this context.

EXPLANATION OF VOTE:

KINCKREHM: It is my belief that this material does not fall within the scope of Article 410. The UL employee who listed this material before it was recognized by the NEC is a member of CMP 21 and for that reason, I believe, the proposal was assigned to CMP 21 for a fair appraisal, that it has received, but the subject does not, in my opinion belong in the Article 410, chapter 6 "Equipment for General Use" it should be in chapter 5 "Special Equipment." The Panel Recommendation is good and could be used with little change in a new Article, which should also include fixture connections by cable assemblies. The future effective date is required because a device "identified for this use" is not now available.

ARTICLE 600 -- ELECTRIC SIGNS AND OUTLINE LIGHTING

600-2(b): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 67 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

DELETE the words "a type approved for the purpose" and replace with "rated for controlling inductive load(s)."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

600-4: Accept

SUBMITTER: CMP 21

PROPOSAL: 67A Delete Section 600-4.

SUBSTANTIATION: This proposal was presented by CMP 21 member, West A. Austin.

A Task Force has been appointed by the CMP 21 Chairman to study any possible hardships this section has imposed on the sign industry.

PANEL RECOMMENDATION: Accept as Revised.

600-4. Listing Required. Every electric sign of any type, fixed or portable shall be listed and installed in conformance with that listing, unless otherwise permitted by special permission.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: B

NEGATIVE: Duffy.

EXPLANATION OF VOTE:

DUFFY: I am not voting on this proposal as such action may be interpreted as self-serving.

600-5: Accept

SUBMITTER: Allen Knickrehm, Los Angeles NECA

PROPOSAL: 68 Delete the reference to Article 250 and replace with "Section 250-97." Delete Exception Nos. 1 and 2.

SUBSTANTIATION: Problem: Bonding rules for signs, etc., appear in two places and are not the same.

Rules should not be repeated by different CMP's as their proposal shows. Exception No. 1 does not provide for safety of workers as required by OSHA. Exception No. 2 is provided for by changing the reference to Section 250-97.

If this proposal is not in compliance with Section 90-3, then Section 250-97 should be deleted and a reference to signs and Section 600-5 should be included in Section 250-2.

PANEL RECOMMENDATION: Accept as Revised.

SECTION 600-5 and Exception No. 1 to remain as is. Revise Exception No. 2 by adding the words "protected from physical damage," after the word "conductors."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 600 -- ELECTRIC SIGNS AND OUTLINE LIGHTING

600-5, Exception No. 2: Reject

SUBMITTER: Peter Pollak, The Aluminum Association

PROPOSAL: 69 After "No. 14" add "copper or No. 12 aluminum,..."

SUBSTANTIATION: This proposal is submitted to clarify the proper size equivalent of aluminum conductor for the application. The size limitation is based upon an ampacity requirement which can be met with an aluminum conductor sized to provide the required ampacity. The panel is referred to the proposed revision in Section 110-5.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by Section 110-15.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

600-6(c)-(New): Accept

SUBMITTER: R. S. Pinkerton, Electrical Code Advisory Committee for City of Los Angeles

PROPOSAL: 70 Add a new (c) as follows:

"A computed load for the required branch circuit installed for the supply of exterior signs or outline lighting shall be computed at a minimum of 1200 watts."

SUBSTANTIATION: Although the Code requires a sign circuit to be installed, it does not provide for a minimum computed load for this circuit. Unrealistically low loads of 180 or 200 watts have been shown on the initial installation which has resulted in overloaded feeders when the 'real' sign of 1,000-1,500 watts is installed. The 1,200 watt minimum load is a realistic value for the average sign installation and will prevent many costly feeders changes caused by failures to properly provide for the sign load on the initial installation.

PANEL RECOMMENDATION: Accept as Revised.

"Change "watts" to "volt-amperes."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

600-6(c)-(New): Reject


PROPOSAL: 71 Add new (c) as follows:

"(c) Ground-Fault Circuit-Interrupter Required. Receptacles supplying outdoor portable, cord- and plug-connected signs shall be protected by a ground-fault circuit-interrupter for personnel."

SUBSTANTIATION: Portable cord- and plug-connected signs used along the roadside, fed from extension cord at the building pose an unsafe condition. The signs are constantly exposed to vandalism and the elements. Their supply is by flexible cords which may be laid across an active roadway, being repeatedly run over by vehicles. The signs have metal frames and are often on rubber tires. It wasn't until the 1978 Code that portable signs were required to be grounded. There are numerous signs built before this change which are still in use. Therefore, if a line-to-frame fault occurs, a person standing on the ground and touching the frame will provide a ground return path. Even if an equipment ground was installed, the usage conditions make it unlikely that it will be adequate for any appreciable time.

Attached are copies of newspaper clippings which document three (3) deaths and three (3) shocks. Many enforcement people have voiced concern regarding this situation.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See panel action on Proposal No. 73A.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
REPORT OF CODE-MAKING PANEL NO. 10

ARTICLE 422 -- APPLIANCES

422-1: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 1 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

1. Delete the second sentence.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-3: Accept

SUBMITTER: Claude E. Deering, Jr., American Petroleum Institute

PROPOSAL: 2 Add "SJ" after "STO."

SUBSTANTIATION: It is proposed that the word "classified" in parentheses after the word "hazardous." is consistent with Article 250, which is entitled "Hazardous (Classified) Locations." The proposed wording recognizes that a location is not hazardous per se, but is classified depending on the properties of the flammable or combustible substance which may be present, and the likelihood that a flammable or combustible concentration or quantity will be present.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-S(a), Exception No. 2: Accept

SUBMITTER: W. M. Shinnick, Hayward, CA

PROPOSAL: 3 Place a comma after the words "motor-operated appliance." 

SUBSTANTIATION: As the exception is presently punctuated, a 25% increase in branch circuit rating is required for every appliance "other than a motor-operated appliance that is continuously loaded." Revises as proposed, the phrase "that is continuously loaded" will properly apply to the appliance in the opening phrase, "For an appliance," not to a "motor-operated appliance."

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-8(d)(1): Accept

SUBMITTER: S. Mazzoni, Underwriters Laboratories Inc.

PROPOSAL: 4 Add "SJ" after "STO."

SUBSTANTIATION: Type SJ cord is a Junior Hard Service Cord per Table 400-4 of the NEC and is equivalent to SJT, SJTST, SJT
d and there is no technical justification for its exclusion. I believe that it was the intent of CMP-10 that it be included and its exclusion was inadvertent.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-8(d)(1): Reject

SUBMITTER: H. B. Love/B. Auger, Michigan Chapter, IAEI

PROPOSAL: 5 Revise to read:

(1) Residential food waste disposers: All such equipment and controls and types of equipment shall be provided with an independent disconnecting means within sight of the equipment and shall be readily accessible. Food waste disposers of one-half horse-power or less shall be wired only with heavy duty 3-wire minimum No. 16 hard service cord and approved cap and three wire "U" slot grounding type receptacles. On new construction, a disconnect switch shall be mounted in the wall adjacent to the sink.

SUBSTANTIATION: To assure the unit is always grounded we propose the above. Our experience shows space under the sink is usually used for storage resulting in damage to the connections of any other wiring methods. Now electrical personnel servicing these units often do not restore wiring to it's original condition. The switch provides safety should a foreign object fall into the appliance.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-8(d)(2): Accept

SUBMITTER: S. Mazzoni, Underwriters Laboratories Inc.

PROPOSAL: 6 Add "SJ" after "STO."

SUBSTANTIATION: Type SJ cord is a Junior Hard Service Cord per Table 400-4 of the NEC and is equivalent to SJT, SJT, SJT and there is no technical justification for its exclusion. I believe that it was the intent of CMP 10 that it be included and its exclusion was inadvertent.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
422-15. Grounding. Appliances required by Article 250 to be grounded shall have exposed noncorroding metal parts grounded in the manner specified in Article 250.

PANEL RECOMMENDATION: Accept as revised.

422-16. Grounding. The provisions of Article 250 apply to the grounding of electric ranges, wall-mounted ovens, counter-mounted cooking units, and clothes dryers.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-21(c)-(New): Reject

SUBMITTER: H. B. Love/B. L. Auger, Michigan Chapter, IAEI

PROPOSAL: 12 Add (c) as follows:

(c) Space Heating Equipment (other than electric heat).

1. A readily accessible disconnect switch shall be mounted on the exterior of the heating equipment or on a surface adjacent to the equipment.

2. Heating equipment which is not readily accessible shall have an additional disconnect installed at the nearest readily accessible location.

SUBSTANTIATION: Providing for safety in servicing of the unit, a disconnect shall be located at the unit. Providing for safety of the person using the unit, a disconnect means shall be provided which is readily accessible in the event of fire or explosion.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change. The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-22(c): Reject

SUBMITTER: E. E. Dillon, Border County Div. IAEI

PROPOSAL: 13 Add the words "fastened in place and" after the word "appliance." 

SUBSTANTIATION: This section is practically unenforceable as there is no method of determining the rating of a portable appliance which may sometime in the future be plugged into a receptacle. See the attached opinion of the San Diego City Attorney.

*See Border County Div. IAEI substantiation for proposal for 110-16(a).

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change. The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-27: Reject

SUBMITTER: C. E. Muhlenman, Marion, IN

PROPOSAL: 14 Revise as follows:

422-27. Overcurrent Protection. Each appliance of less than 15 amperes load and all connected appliance shall have overcurrent protection built into the appliance or its cord cap. Appliances having loads equal to or more than 15 amperes are not connected by cord, may be protected by an overcurrent device in a dedicated branch circuit. These overcurrent devices shall not exceed 150 percent of the appliance load. The requirements in (a) and (b) below shall apply.

Delete present (a) and (e). Reidentify remaining paragraphs (b), (c), (d), and (f).

SUBSTANTIATION: To prevent small faults from not being detected by a large overcurrent device and will reduce fires and damage to appliances.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-27(a): Accept

SUBMITTER: Idaho Chapter, IAEI

PROPOSAL: 15 Reword 422-27(a) to include (f) which would then read:

(a) Appliances shall be considered as protected against overcurrent if supplied by branch circuits as specified in (e) and (f) below and in Sections 422-5 and 422-6.

SUBSTANTIATION: No direct reference is made to requirements for overcurrent protection of water heaters of larger types. By including Part (f) in this section, specific requirements will be prescribed.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-27(f), Exception No. 2 b.: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 16 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 424 -- FIXED ELECTRIC SPACE HEATING EQUIPMENT

424-1: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 17 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-2: Accept

SUBMITTER: Claude E. Deering, Jr., American Petroleum Institute

PROPOSAL: 18 Add the word "classified" in parenthesis after the word "hazardous."

SUBSTANTIATION: It is proposed that the word "classified," in parenthesis, be inserted after the word "hazardous." This is consistent with Article 500, which is entitled "Hazardous Locations." The proposed wording recognizes that a location is not hazardous per se, but is classified depending on the properties of the flammable or combustible substance which may be present, and the likelihood that a flammable or combustible concentration or quantity will be present.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-3(b): (ASI 1978 NEC): Accept

SUBMITTER: International Association of Electrical Inspectors

PROPOSAL: 19 Amend Section 424-3(b), Paragraph 1, Sentence 1, to read:

(b) Branch-Circuit Sizing. The size of branch-circuit conductors and overcurrent protective devices supplying fixed electric space heating equipment consisting of resistance elements with or without a motor shall be computed on the basis of 125-150 percent of the total load of the motors and the heaters.

SUBSTANTIATION: It should be recognized that 125 percent is exacting and practically impossible to obtain. Guide lines were originally provided in Section 210-20(b) of the 1971 NEC. However, this was deleted in the 1975 NEC. Under our present requirement, judgment could rule to pick something less than 125 percent but close to it and no one can define "close." Anything less than 125 percent will provide the guide lines that are needed.

PANEL RECOMMENDATION: Accept as Revised.

(b) Branch-Circuit Sizing. The ampacity of the branch-circuit...
422-15. Grounding. Appliances required by Article 250 to be grounded shall have exposed noncurrent-carrying metal parts grounded in the manner specified in Article 250. (FPN) See Sections 250-42, 250-43, and 250-45 for equipment grounding of refrigerators and freezers and Sections 250-57 and 250-60 for equipment grounding of electric ranges, wall-mounted ovens, counter-mounted cooking units, and clothes dryers.

422-16: Reject CMP 10

PANEL RECOMMENDATION: Unanimously Affirmative.

422-21(c)-(New): Reject CMP 10

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: CMP agrees with the intent of the Proposal. See action on Proposal No. 10A.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-21(c): Reject CMP 10

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change. The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-22(c): Reject CMP 10

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change. The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

422-27: Reject CMP 10

PANEL RECOMMENDATION: Unanimously Affirmative.

PANEL COMMENT: The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
The NEC should, as always, give the industry the method for a safe installation for the protection of the public, but let our inspectors in charge determine the method.

PANEL RECOMMENDATION: Unanimously Affirmative.

JORDAN: My vote is to reject, as is the Panel's vote, but not for the same reason. See Proposal No. 24.

PANEL RECOMMENDATION: Unanimously Affirmative.

The NEC should, as always, give the industry the method for a safe installation for the protection of the public, but let our inspectors in charge determine the method.

PANEL RECOMMENDATION: Unanimously Affirmative.

The wire manufacturers do not have a standard production of 2/0 and 3/0 cable required for the 30 kW and 35 kW and larger space heaters. Most of the contractors have to special order this material.

PANEL RECOMMENDATION: Accept as Revised: Unanimously Affirmative.

The NEC should, as always, give the industry the method for a safe installation for the protection of the public, but let our inspectors in charge determine the method.

PANEL RECOMMENDATION: Unanimously Affirmative.

The NEC should, as always, give the industry the method for a safe installation for the protection of the public, but let our inspectors in charge determine the method.

PANEL RECOMMENDATION: Unanimously Affirmative.

The NEC should, as always, give the industry the method for a safe installation for the protection of the public, but let our inspectors in charge determine the method.

PANEL RECOMMENDATION: Unanimously Affirmative.

The NEC should, as always, give the industry the method for a safe installation for the protection of the public, but let our inspectors in charge determine the method.

PANEL RECOMMENDATION: Unanimously Affirmative.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-22(b) and (c): Accept

SUBMITTER: D. C. Rockholm, Underwriters Laboratories Inc.

PROPOSAL: 25 Revise as follows:

(1) Resistance-Type Heating Elements. Electric space heating equipment shall be protected at not more than 60 amperes. Equipment employing such elements rated more than 48 amperes shall have the heating elements subdivided, and each subdivided load shall not exceed 48 amperes.

Exception: As provided in Section 424-77(a).

(c) Overcurrent Protective Devices. Supplementary overcurrent protective devices for the subdivided loads specified in (1) above shall comply with Section 424-22(c).

SUBSTANTIATION: The present wording of Section 424-22(b) does not place any limit on the size of overcurrent protection of electric space heating equipment rated 48 amperes or less. I do not believe it was ever intended to allow such equipment to be protected with a larger size overcurrent protective device than permitted for an identical subdivided load of a large heater. The proposed wording to Section 424-22(b) would correct this apparent oversight but would also require the addition of the words "for the subdivided loads" to Section 424-22(c) to define the overcurrent protective devices referenced in this Section.

PANEL RECOMMENDATION: Accept as Revised.

Add a paragraph to the end of (b) as follows:

Where a subdivided load is less than 48 amperes, the rating of the overcurrent protective device shall comply with Section 424-3(b).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-22(c): Reject

SUBMITTER: T. H. Halton, Jr.

PROPOSAL: 26 Wording to be deleted.

RECOMMENDED TEXT: Delete paragraph (c) Overcurrent Protective Devices.

SUBSTANTIATION: This is a companion proposal to clarify the recommendation for this proposal on page 180. In the Tarrant County area of Texas we have had complaints by the homeowner trying to replace the fuses and of being shocked. All of their complaints were checked and all units were wired according to N.E.C. including the marking on the units with notices to disconnect unit before removing any doors.

The homeowner tried to replace these fuses because he has called in the repairman to fix his furnace and the repairman does not always disconnect the unit, he will pull the fuses and check them. If he finds one blown he replaces said fuse and sends a bill for or collects for the call. The next time the unit quits, the homeowner goes by the nearest store and will purchase enough 20 ampere fuses to replace at his request. He attempts to put in new fuses and not being equipped, nor knowing what he is doing, will be shocked. The public will try to do anything to save money. The fuses in the units are a hazard to the public and service men.

The proposed change in Article 424-19 will enable the electrical inspector to have installed a sub-panel in the heater closet and connect the electric furnace from that panel. The heating unit manufacturers are making their units over 20 kw with one feed and even 5 kw. This creates a problem for the installer. He installs for two feeds and on the final finds a one feed. The larger units requiring 30 kw and 35 kw feeds creating a mess with the 20 and 30 kw cable as no manufacturer of cable has a standard production of this size cable.

This Section of the N.E.C. as it is presently in the Code, is another example of writing a technical Code. No reflection on our wonderful Code Panels, they work so hard to write the Code clearly. I personally believe that our Code should mainly stay on the performance side. This change back to the original Code will enable the inspectors to perform their duties on a more equal and safer installation.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-22(e): Accept

SUBMITTER: D. C. Rockholm, Underwriters Laboratories Inc.

PROPOSAL: 27 Revise as follows:

(e) Conductors For Subdivided Loads. Field wired conductors between the heater and the supplementary overcurrent devices shall have the same ampacity as required for branch-circuit conductors in accordance with Section 424-3(b) based on the connected load. The supplemental overcurrent protective devices specified in (c) above shall protect these conductors in accordance with Section 220-3.

SUBSTANTIATION: The present wording of Section 424-22(e) apparently rules out the use of Exception No. 1 to Section 220-3, which I do not believe was intended. Furthermore, the exception to 424-22(e) was apparently based on the exception to 424-22(d).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-24, Exception-(New): Accept

SUBMITTER: J. J. Kark, National Electrical Manufacturers Assn.

PROPOSAL: 28 Add an exception as follows:

Exception: Panels approved for the purpose shall be permitted with shorter leads.

SUBSTANTIATION: The present wording does not allow for the installation of heating panels approved for the purpose using wiring systems other than 7 foot heating leads. The addition of this exception will correct this.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-35 (a): Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 29 The second sentence should be revised to read:

These wire shall have the following color identification to indicate the circuit voltage on which it is to be used, etc.

SUBSTANTIATION: To conform to the method to express circuit voltage as per guidelines developed by the TSC on nominal voltage.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-41(e): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 30 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
PANEL RECOMMENDATION: Accept as Revised:

Delete the phrase "approved for the purpose" and replace with "identified as suitable for use at the elevated temperatures."  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-41(f), Exception: Accept  

SUBMITTER: TSC-Approved for the Purpose  
PROPOSAL: 31 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.  
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.  
PANEL RECOMMENDATION: Accept as Revised:

Submittal: Cables identified to be secured at intervals not to exceed 6 feet.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-44(e): Accept  

SUBMITTER: H.F. van der Voort, Cleveland, OH  
PROPOSAL: 32 Add "rigid nonmetallic conduit" after "Intermediate metal conduit" and "electrical metallic tubing."  
SUBSTANTIATION: The rigid nonmetallic conduit for this application is Schedule 40 PVC and has excellent mechanical strength; both crush and impact. This strength is equivalent to that of EMT and the proposed wording indicates this. Unless severe physical damage is imminent, protection of the conduit is unnecessary. Carlson tested both Schedule 40 and EMT in its own research facilities to demonstrate this. The test methods are those called for in UL611. The test results are shown on the following table.

IMPACT RESISTANCE MEASUREMENTS ON PVC SCHEDULE 40 CONDUIT & ELECTRICAL METALLIC TUBING  
Percent Decrease in Inside Diameter

<table>
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<th>Diameter</th>
<th>PVC Schedule 40</th>
<th>EMT</th>
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Crush Load in Pounds to Achieve 30% Deflection

<table>
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<th>EMT</th>
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<td></td>
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PANEL RECOMMENDATION: Accept.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-60: Accept  

SUBMITTER: TSC-Approved for the Purpose  
PROPOSAL: 34 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.  
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.  
PANEL RECOMMENDATION: Accept as Revised:

Delete the words "approved for the purpose and so marked" and replace with "identified as suitable for use at the elevated temperatures."  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-65: Reject  

SUBMITTER: R. S. Pinkerton, Los Angeles, CA  
PROPOSAL: 35 Add the word "safely" before the word "accessible."  
SUBSTANTIATION: Duct heater controllers are being installed in locations which have the proper workspace but are impossible to reach for routine maintenance without subjecting the workman to serious risks of tripping and falling. The present Code requirements provide for a safe workspace about equipment but do not provide for a safe passageway to the workspace.  
PANEL RECOMMENDATION: Reject.  
PANEL COMMENT: The supporting comment does not justify the proposed change. The present wording adequately reflects the Panel's intent.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-71: Accept  

SUBMITTER: TSC-Approved for the Purpose  
PROPOSAL: 36 Add the word "safely" in front of "accessible" to read: Duct heater controller equipment shall be safely accessible with the disconnecting means installed at or within site from the controller.  
SUBSTANTIATION: Duct heater controllers are being installed in locations which have the proper workspace but are impossible to reach for routine maintenance without subjecting the workman to serious risks of tripping and falling. The present Code requirements provide for a safe workspace about equipment but do not provide for a safe passageway to the workspace.  
PANEL RECOMMENDATION: Accept as Revised:  
PANEL COMMENT: The supporting comment does not justify the proposed change. The present wording adequately reflects the Panel's intent.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-72(a), (b), and (c): Accept  

SUBMITTER: D. C. Rockholm, Underwriters Laboratories Inc.  
PROPOSAL: 38 Revise as follows:

(a) A boiler employing resistance-type immersion heating elements contained in an ASME rated and stamped vessel shall have the heating elements protected at not more than 150 amperes. Such a boiler rated more than 120 amperes shall have the heating elements subdivided into loads not exceeding 120 amperes.

(b) A boiler employing resistance-type heating elements not contained in an ASME rated and stamped vessel, shall have the heating elements protected at not more than 60 amperes. Such a boiler rated more than 48 amperes will have the heating elements subdivided into loads not exceeding 48 amperes.

(c) The supplemental overcurrent protective devices for the subdivided loads as required by...

SUBSTANTIATION: The present wording of Section 424-72(b) does not place any limit on the size of overcurrent protection of resistance type immersion heating elements in boilers rated 48 amperes or less when the elements are not contained in an ASME rated and stamped vessel. I do not believe it was ever intended to allow such elements to be protected with a larger size overcurrent protective device than permitted for an identical subdivided load of a larger boiler. The proposed wording of 424-72(b) is intended to correct this apparent oversight. The proposed wording to 424-72(a) is for clarification and consistency with 424-72(b). The proposed wording in Section 424-72(a) and (b) would also require the addition of the words "for the subdivided loads" to Section 424-72(c) to define the overcurrent protective devices referenced in this section.
PANEL RECOMMENDATION: Accept as Revised: "In the second sentence of (b) change "shall" to "shall." And, also add a paragraph to (a) as follows:
Where a subdivided load is less than 120 amperes, the rating of the overcurrent protective device shall comply with Section 424-3(b).
Add a paragraph to (b) as follows:
Where a subdivided load is less than 48 amperes, the rating of the overcurrent protective device shall comply with Section 424-3(b).
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-72(e): Accept
SUBMITTER: D. C. Rockholm, Underwriters Laboratories Inc.
PROPOSAL: 39 Revise as follows:
(a) Conductors for Subdivided Loads. Field-wired conductors between the heater and the supplementary overcurrent protective devices shall have the same ampacity as required for branch-circuit conductors in accordance with Section 240-3(b) based on the connected load. The supplementary overcurrent protective devices specified in (c) above shall protect these conductors in accordance with Section 240-3.
SUBSTANTIATION: The present wording of Section 424-72(e) apparently rules out the use of Exception No. 1 to Section 240-3, which I do not believe was intended. Furthermore the Exception to 424-72(d) was apparently based on the Exception to 424-72(d). It is my understanding that the basis for the exception to 424-72(d) is that on large heaters having individually controlled subdivided loads it is unlikely that all of these individual loads will be energized simultaneously for extended periods of time and therefore the conductors supplying the supplementary overcurrent protective devices would not be carrying the total heater current for extended periods. However, this logic is not applicable to the subdivided loads where it is quite possible for one or more such loads to be energized continuously in a large heater (50 Kw or more).
PANEL RECOMMENDATION: Accept as Revised:
(a) Conductors for Subdivided Loads. Field-wired conductors between the heater and the supplementary overcurrent protective devices shall be sized at not less than 125 percent of the load served. The supplementary overcurrent protective devices specified in (c) shall protect these conductors in accordance with Section 240-3.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-80: Accept
SUBMITTER: TSC-Nominal Voltage
PROPOSAL: 40 Add "nominal" after the word "volts" in second line.
SUBSTANTIATION: To conform to the method to express system voltage as developed by the TSC on nominal voltage.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-81: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 41 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-85: Accept
PROPOSAL: 42 Revise as follows:
For those boilers designed such that fault currents do not pass through the pressure vessel and the pressure vessel is electrically isolated from the electrodes, all exposed noncurrent carrying metal parts including the pressure vessel, supply and return connecting piping shall be grounded in accordance with Article 250.
For all other designs the pressure vessel containing the electrodes shall be isolated and electrically insulated from ground.
SUBSTANTIATION: Aerco International, Inc. presently manufactures an electrode Hot Water Boiler that is U.L. listed (UL File 4E-29427).
I have enclosed a pictorial representation of same.
We believe the grounding requirement, Para. 424-85 of the 1978 NEC is designed to cover those boilers where fault currents can flow to neutral. However, the code does not specifically address our design, where fault currents cannot flow to ground through the pressure vessel shell.
As indicated on the sketch, the halar coated heads and the polysulfone shielded act to form an electrically isolated chamber for the electrode assembly. The PPS bushing insulated the entire electrode assembly from the steel pressure vessel.
The electrically "hot" electrodes are isolated from the support shaft and rotating shaft by ceramic arms supported by polysulfone discs. The rotating shaft if further isolated by encapsulation in teflon tubing. A top guard of perforated metal enclosing the exposed components prevents personnel from contacting any portion of the assembly. The electrode assembly is insulated from the inside of the tank, it is not necessary to bring the neutral from the supply to the boiler. However, we do connect the electrode assembly structure to neutral to prevent any possible personnel hazard. The outer enclosure is locally grounded.
It is understood that the Electrode Boiler has met the 0.5 amp maximum ground current tests as specified by the Underwriters Laboratories, Inc. The proposed recommended text attempts to address the above problem.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 426 - FIXED OUTDOOR ELECTRIC DE-ICING AND SNOW MELTING EQUIPMENT

426-3 Exception-(New)(HOD 1978 NEC): Reject
SUBMITTER: Pipeline Heating Systems, Inc., Brecksville, OH
PROPOSAL: 43 Add at end of paragraph:
Exception: Skin effect current tracing circuits. See Section 426-34.
SUBSTANTIATION: Same as Proposal No. 57 to 1978 preprint.
PANEL RECOMMENDATION: Reject.
PANEL COMMENT: CMP agrees with intent of proposal. See action on Proposal No. 46.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

426-23: Reject
SUBMITTER: Warren H. Cook, IEEE
PROPOSAL: 44 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
PANEL RECOMMENDATION: Reject.
PANEL COMMENT: See action on Proposal No. 46.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COMMENT ON VOTE:
ERICKSON: I feel that Panel Comment should be changed to "CMP agrees with intent of Proposal." See action on Proposal No. 46.

426 Part D-(New)(HOD 1978 NEC): Accept
Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.
SUBMITTER: Pipeline Heating Systems, Inc., Brecksville, OH
PROPOSAL: 45 Add a new Part D to Article 426 as follows:
D. Skin Effect Current Tracing
426-30. Scope. The provisions of Part D of this article shall apply to fixed outdoor electric de-icing or snow melting equipment utilizing a tubular resistive heating element of ferromagnetic material and having within the tubular element an electrically insulated insulating coating such that the skin effect of alternating current causes the main heating current to concentrate near the inner wall of the tubular element.
(a) The electrical insulation of the inner conductor shall have a temperature rating greater than the operating temperature of the cable for the specific system based on the designs and tests of the manufacturer.
(b) The electrical insulation of the inner conductor shall have a voltage rating at any point on the system higher than the operating voltage at that point.
(c) The outer conductor (tubular element) shall not require electrical insulation provided its outer surface is effectively grounded at one or more locations.
424-72(e): Accept
SUBMITTER: D. C. Rockholm, Underwriters Laboratories Inc.
PROPOSAL: 39 Revise as follows:
1. Conductors for Subdivided Loads. Field-wired conductors between the heater and the supplementary overcurrent protective devices shall have the same ampacity as required for branch-circuit conductors in accordance with Section 240-3 based on the connected load. The supplementary overcurrent protective devices specified in (c) above shall protect these conductors in accordance with Section 240-3.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-72(d). It is my understanding that the basis for the exception to 424-72(d) was apparently based on the Exception to 424-72(e) rather than what is actually now being discussed.

VOTE ON PANEL RECOMMENDATION: Rejected.

424-72(d). It is my understanding that the basis for the exception to 424-72(d) is that on large heaters having individually controlled subdivided loads it is unlikely that all of these individual loads will be energized simultaneously for extended periods of time and therefore the conductors supplying the supplementary overcurrent protective devices would not be carrying the total heater current for extended periods. However, this logic is not applicable to the subdivided loads where it is quite common for one or more such loads to be energized continuously in a larger heater (50 Kw or more).

VOTE ON PANEL RECOMMENDATION: Accept as Revised.

424-80: Accept
SUBMITTER: TSC-Nominal Voltage
PROPOSAL: 40 Add and/or after the word “volts” in second line.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-81: Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 41 See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

424-81. Identification. Electrode-type boilers shall be identified as suitable for the installation.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.


VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

426 Part D- (New) (H00 1978 NEC): Accept
SECRETARY’S NOTE: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.

SUBMITTER: Pipeline Heating Systems, Inc., Brecksville, OH

PROPOSAL: 48 Add a new Part D to Article 426 as follows:

D. Skin Effect Current Tracing

426-30. Scope. The provisions of Part D of this article shall apply to fixed outdoor electric de-icing or snow melting equipment utilizing a tubular resistive heating element of ferromagnetic material and having within the tubular element an electrically insulated conductor arranged so that the skin effect of alternating current causes the main heating current to concentrate near the inner wall of the tubular element. The skin effect of the inner conductor shall have a temperature rating greater than the operating temperature of the cable for the specific system based on the designs and tests of the manufacturer.

(b) The electrical insulation of the inner conductor shall have a voltage rating at any point on the system higher than the operating voltage at that point.

(c) The outer conductor (tubular element) shall not require electrical insulation provided its outer surface is effectively grounded at one or more locations.

ARTICLE 426 - FIXED OUTDOOR ELECTRIC DE-ICING AND SNOW MELTING EQUIPMENT

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
426-32. Single Cable. A single cable may be used as the internal return conductor if the provisions of Section 426-31(a) are met. 426-33. Pull Boxes. Pull boxes for the inner cable shall be accessible without excavation by being placed in suitable vaults or on above grade structures. 426-34. Branch-Circuit Requirements. The branch-circuit supplying a skin effect current tracing system shall be listed in current rating by Section 426-3, and shall meet all applicable branch-circuit requirements of this Code. 426-35. Above Ground Installations. Skin effect current tracing systems may be installed in exposed locations, such as substation and bridge structures, without falling ice, provided the heating element is grounded at the power feed location and at the termination of the circuit. SUBSTANTIATION: Skin effect current tracing has been used with great success in Japan for snow melting on garage ramps, airport aprons, and electrical substation structures. The principle of operation is detailed in a literature attached to our proposed amendment to Article 427. This method is especially suitable for heating concrete slabs because the heating cable has the noncorroding characteristic in concrete that steel reinforcing rod has and is also of adequate strength to be unaffected by shrinkage or settlement of the slab. It has the unique advantage that the inner cable can be replaced and full function restored without breaking up the slab if any maintenance problem occurs. The main heating element, being of fully welded heavy wall construction, is not subject to failure in service unless there is catastrophic breakage of the slab. The thermal and electrical characteristics of the system are such that several thousand square feet can be heated with 100 watts per square foot from a single circuit. A skin effect current tracing heat element, having roughly the same dimensions and rigidity, can be installed and used to create heat in the tube; although not strictly by induction. Skin effect current tracing systems may be installed in exposed locations, such as on above grade structures.

The purpose of each amended paragraph is explained here:

426-31(a). In most cases it is possible to operate code rated cables at higher ratings in skin effect heating systems. This is permitted by Table 310-16 without exceeding the temperature rating of the cable as given in Table 310-16. Normal code ampacity is based on ohmic conductors in a conduit and with the thought that heat loss from the conduit might be limited by enclosure within an insulated stud wall, for example. In a skin effect tracing system, one cable, not three, is producing heat. More importantly, the temperature of the raceway is known and bears a definite relationship to the pipeline temperature and the overall thermal parameters of the system. Since the temperature and not current is the true basis of any rating, it is possible to design with higher currents when all facts are known; a wide margin for error is thus unnecessary.

426-31(c). Section 310-2 states "Conductors shall be insulated." The heat tube of a skin effect system is in truth insulated by electromagnetic properties; under normal or fault conditions the outer surface is always isolated (insulated) from the circuit voltage. But in every other application the Code thinks in terms of circuit theory rather than wave theory. In order to avoid possible misunderstandings, this paragraph is included. The presence of a ground assures the absence of voltage. There are technical approaches to this specific situation that are somewhat more definitive, but are felt inappropriate for the NEC.

426-32. Section 300-20 requires that "all phase wires be grouped" when in a metal raceway to avoid heating some surrounding metal by induction. The usual situation this section prohibits is obviously hazardous, for very high uncontrolled temperatures are possible. A skin effect tracing system requires a single conductor in a metal tube specifically to create heat in the tube, although not strictly by induction. This is permissible because the temperature of the system is known, and is part of the design.

426-33. Self explanatory.

426-34. Self explanatory.

426-35. Skin effect current tracing heat elements are always of steel and typically are from 3/4 inch to 2 inches in O.D. and with a wall thickness greater than 0.100 inches. They do not require protective metal cladding in most instances. A single ground will assure that no potential can occur on the heating element under normal or fault conditions; a second ground is simply a conservative redundancy.

panel recommendation: Accept as Revised.

ARTICLE 426-FIXED OUTDOOR ELECTRIC DE-ICING AND SNOW-MELTING EQUIPMENT

A. General

426-1. Scope. The requirements of this article shall apply to electrically energized heating systems and the installation of these systems:

(a) Embedded in driveways, walks, steps and other areas.
(b) Exposed on drainage systems, bridge structures, roofs and other structures.

426-2. Definitions. For the purpose of this article:

Heating System. A complete system consisting of components such as heating elements, fastening devices, nonheating circuit wiring, leads, temperature controllers, safety signs, junction boxes, raceways and fittings.

Resistance Heating System. A specific separate element to generate heat which is embedded in or fastened to the surface to be heated.

(Tabular heaters, strip heaters, heating cable, heating tape, heating panels, are examples of resistance heaters.)

Impedance Heating System. A system in which heat is generated in the pipe or rod or conductor, by causing current to flow through the pipe or rod by direct connection to an ac voltage source from a dual-winding transformer. The pipe or rod shall be permitted to be embedded in the surface to be heated, or constitute the exposed components to be heated.

Skin Effect Heating System. A system in which heat is generated on the inner surface of a ferromagnetic envelope embedded in or fastened to the surface to be heated.

Typically, an electrically insulated conductor is routed through and connected to the envelope at the other end. The envelope and the electrically insulated conductor are connected to an ac voltage source from a dual-winding transformer.

426-3. Application of Other Articles. All requirements of this Code shall apply except as specifically amended in this article. Fixed outdoor electric de-icing and snow-melting equipment for use in highway, classified locations shall comply with Articles 500 through 516.

426-4. Branch-Circuit Requirements. The ampacity of branch-circuit conductors and size of overcurrent protective devices supplying fixed outdoor electric de-icing and snow-melting equipment shall be calculated on the basis of 125 percent of the total load of the heaters. Fixed outdoor electric de-icing and snow-melting installations shall be permitted to be supplied by 15-, 20-, 25-, 30-, 40-, or 50-ampere circuits if the circuit supplies no other load.

426-5. Service-Entrance Protection. Fixed outdoor de-icing and snow-melting equipment employing methods of construction or installation other than covered by this article may be used only by special permission.

C. Resistance Heating Elements


(a) Watt Density. Panels or units shall not exceed 120 watts per square foot of bottom area.

(b) Spacing. The spacing between adjacent cable runs is dependent upon the rating of the cable, and shall not be less than one inch on center or 1-1/2 inches thick and have at least 1-1/2 inches of asphalt or masonry applied over the units, panels or cables; or

(c) Cover. Units, panels or cables shall be installed:

(1) On a substantial asphalt or masonry base at least 2 inches thick and have at least 1-1/2 inches of asphalt or masonry applied over the units, panels or cables; or

(2) They shall be permitted to be installed over other approved bases and embedded within 3-1/2 inches of masonry or asphalt but not less than 1-1/2 inches from the top surface; or

(3) Equipment that has been specially investigated for other forms of installation may be installed only in the manner for which it has been investigated.

(d) Secured. Cables, units and panels shall be securely in place by means of anchors or other approved means while the masonry or asphalt finish is applied.

(e) Expansion and Contraction. Cables, units, and panels shall not be installed where they extend beyond the expansion joints unless adequately protected from expansion and contraction.

426-21. Exposed De-icing and Snow-Melting Equipment. Exposed de-icing and snow-melting equipment shall be securely to the surface being heated by approved means.

(b) Overtemperature. Where the heating element is not in direct contact with the surface being heated, the design of the heater assembly shall be such that its temperature limitations shall not be exceeded.

(c) Expansion and Contraction. Heating elements and assemblies shall not be installed where they slide expansion joints unless provision is made for expansion and contraction.

(d) Flexural Capacity. Where flexural structures, the heating elements and assemblies shall have a flexural capability compatible with the structure.
426-22. Installation of Nonheating Leads for Embedded Equipment. (a) Grounding Sheath or Braiding. Nonheating leads having a grounding sheath or braiding shall be embedded in the masonry or asphalt in the same manner as the heating cable without additional mechanical protection.

(b) Raceways. Raceways not more than 6 inches of nonheating leads of Type TW and other approved types not having a grounding sheath shall be enclosed in a rigid conduit, electrical metallic tubing, intermediate metal conduit, or support hardware shall be installed in accordance with Section 426-25 are not retained. Not more than 6 inches of nonheating leads shall be provided within the junction box.

(c) Bushings. Where nonheating leads are installed in the asphalt or masonry where leads enter conduit or tubing. (d) Expansion and Contraction. Leads shall be protected in expansion joints from masonry or asphalt or masonry; and the distance from the factory splice to raceway shall be not less than one inch or more than 6 inches. (e) Leads in Junction Boxes. Nonheating leads shall be installed in a rigid conduit, electrical metallic tubing, intermediate metal conduit, other raceways, or other approved means.

426-23. Installation of Nonheating Leads for Exposed Equipment. (a) Nonheating Leads. Power supply nonheating leads (cold leads) for resiliently mounted for the temperature encountered. Preassembled nonheating leads on approved heaters shall be permitted to be shortened if the markings specified in Section 426-25 are retained. Not more than 6 inches of nonheating leads shall be provided within the junction box.

(b) Protection. Power supply nonheating leads shall be enclosed in a rigid conduit, intermediate metal conduit, or support hardware shall be installed in accordance with Sections 210-14 and 300-15.

426-25. Marking. Each factory-assembled heating unit shall be legibly marked within 6 inches of each end of the nonheating leads with the permanent identification symbol, catalog number, and ratings in volts and watts, or in volts and amperes.

426-26. Corrosion Protection. Ferrous or nonferrous metal raceways, cable armor, cable sheaths, boxes, fittings, supports and support hardware shall be permitted to be installed in concrete or in situations subject to severe corrosive influences, when made of material suitable for the condition, or when provided with corrosion protection identified as suitable for the condition.

426-27. Grounding. (a) Metal Parts. Exposed noncurrent-carrying metal parts of equipment likely to become energized shall be grounded as required in Article 250.

(b) Grounding Braid or Sheath. Grounding means, such as copper braid, metal sheath, or other approved means, shall be provided as part of the heated section of the cable, panel, or unit.

(c) Bonding and Grounding. All noncurrent-carrying metal parts that are likely to become energized shall be bonded together and connected to an equipment grounding conductor sized in accordance with Table 250-95, extending to the distribution panelboard.

D. Impedance Heating

426-30. Personnel Protection. Exposed elements of impedance heating systems shall be physically guarded, isolated, or thermally insulated with weatherproof jacket to protect against contact by personnel in the area.

426-31. Voltage Limitations. The impedance heated elements shall not operate at a voltage greater than 30 volts ac. Exception: The voltage shall be permitted to be greater than 30 volts, but not more than 80 volts, if a ground-fault circuit-interrupter for personnel protection is provided.

426-32. Isolation Transformer. A dual-winding transformer with a grounded shield between the primary and secondary windings shall be used to isolate the distribution system from the heating system.

426-33. Induced Currents. All current-carrying components shall be installed in accordance with Section 300-20.

426-34. Grounding. A grounded circuit is operating at a voltage greater than 30, but not more than 80, shall be grounded at designated point(s).

E. Skin Effect Heating

426-40. Conductor Ampacity. The ampacity of the electrically insulated conductor inside the ferromagnetic envelope shall be permitted to exceed the values shown in Article 310, provided it is identified and listed for this purpose. Conductors shall not be used where boxes are installed without the provision of a protective opening.

426-41. Pull Boxes. Where pull boxes are used they shall be accessible without excavation by location in suitable vaults or above grade. Outdoor pull boxes shall be of watertight construction.

426-42. Single Conductor in Enclosure. The provisions of Section 300-20 shall not apply to the installation of a single conductor in a ferromagnetic envelope (metal enclosure).

426-43. Corrosion Protection. Ferromagnetic envelopes, ferrous or nonferrous metal raceways, boxes, fittings, supports and support hardware shall be permitted to be installed in concrete in direct contact with the earth, or in areas subject to severe corrosive influences, where made of material suitable for the condition, with proper corrosion protection identified as suitable for the condition. Corrosion protection shall maintain the original wall thickness of the ferromagnetic envelope.

426-44. Grounding. The ferromagnetic envelope shall be grounded at both ends; and, in addition, it shall be permitted to be grounded at intermediate points as required by its design. The provisions of Sections 250-26 shall not apply to the installation of skin effect heating systems.

426-50. Disconnecting Means. All fixed outdoor de-icing and snow-melting equipment shall be provided with a means for disconnection from all ungrounded conductors. Where readily accessible to the user of the equipment, the branch-circuit switch or circuit breaker shall be permitted to serve as the disconnecting means. Switches used as the disconnecting means shall be of the indicating type.

426-51. Controllers. (a) Temperature Controller With "Off" Position. Temperature controlled switching devices which indicate an "off" position and which interrupt line current shall be permitted as the disconnecting means. These devices shall not be permitted to serve as the disconnecting means unless provided with a positive lockout in the "off" position.

(b) Temperature Controller Without "Off" Position. Temperature controlled switching devices which do not have an "off" position shall not be permitted as the disconnecting means.

(c) Remote Temperature Controller. Remote controlled temperature actuated devices shall not be required to meet the requirements of Section 426-51(a). These devices shall not be permitted to serve as the disconnecting means.

(d) Combined Switching Devices. Switching devices consisting of combined temperature actuated devices and manually controlled switches which serve both as the controller and the disconnecting means shall comply with all of the following conditions:

1. Open all ungrounded conductors when manually placed in the "off" position, and
2. be so designed that the circuit cannot be energized automatically if the device has been manually placed in the "off" position, and
3. be provided with a positive lockout in the "off" position.

426-52. Overcurrent Protection. Fixed outdoor electric de-icing and snow-melting equipment shall be considered as protected against overcurrent where supplied by one of the branch circuits as specified in Section 240-4.

426-53. Exception: The use of the words "for personnel protection" although not defined by the NEC, may imply to inspectors a 5 mA device. These devices would be inoperative on an impedance heating circuit since there is more than 5 mA on the coil current than 5 mA. What is a WPI as defined by the NEC which would operate at a lower current to ground than the circuit protective device. I recommend these words be deleted.

COMMENT ON VOTE: ERICKSON: Although I agree with the panel action on this proposal I would like to comment on certain sections.

Section 426-4: Change first sentence to read "The ampacity of branch-circuit conductors supplying fixed outdoor electric de-icing and snow-melting equipment shall be in accordance with Section 310-15. The rating or setting of overcurrent protective devices shall be in accordance with Section 240-3, Exception No. 1 and Section 210-22(c) where applicable. See Explanation for Vote on Proposal No. 19.

Section 426-31: Exception. The use of the words "for personnel protection" although not defined by the NEC, may imply to inspectors a 5 mA device. These devices would be inoperative on an impedance heating circuit since there is more than 5 mA on the coil current than 5 mA. What is a WPI as defined by the NEC which would operate at a lower current to ground than the circuit protective device. I recommend these words be deleted.

JORDAN: The following comments are editorial:

1. It is suggested that the first sentence of Section 426-4 be revised to conform with Proposal No. 19 to assure consistency.

2. In Section 426-10(D): Change the word "installation" to "installed."

3. In Section 426-12: Third line; delete word "surface," which is redundant.

4. Section 426-14: In 3rd line change "may" to "shall."

5. In Section 426-26(A): Change word "mechanical" to "physical," to conform to code nomenclature.

6. The word "approved" is used 5 or 6 times and should be scrutinized to assure conformance with the technical sub-committee's findings on "approved for the purpose."
ARTICLE 427 -- FIXED ELECTRIC HEATING EQUIPMENT FOR PIPELINES AND VESSELS

Article 427: Accept

CMP 10

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in written form by TSC.

SUBMITTER: TSC-Skin Effect Current Tracing

PROPOSED: 67

REVISE AS FOLLOWS: ARTICLE 427-FIXED ELECTRIC HEATING EQUIPMENT FOR PIPELINES AND VESSELS

A. General

427-1. Scope. The requirements of this article shall apply to electrically energized heating systems and the installation of these systems used with pipeline and/or vessels.

427-2. Definitions. For the purpose of this article:

(a) Pipeline: A pipeline is a length of pipe including pumps, valves, flanges, control devices, strainers and/or similar equipment for conveying fluids.

(b) Vessel: A vessel is a container such as a barrel, drum or tank for holding fluids or other material.

(c) Integrated Heating System: An integrated heating system is a complete system consisting of components such as pipelines, vessels, heating elements, heat transfer medium, thermal insulation, moisture barrier, nonheating leads, temperature controls, safety controls and accessories for pipelines and vessels.

(d) Resistance Heating Element: A resistance heating element is a specific separate element to generate heat which is applied to the pipeline or vessel externally or internally. Types of heaters include electrically energized heater, strip heater, heating cable, heating tape, heating blanket, immersion heater, etc. Examples of resistance elements are resistance strip elements, heating elements, etc.

(e) Induction Heating System: An induction heating system is a system in which heat is generated in a pipeline or vessel wall by causing current to flow through a pipeline or vessel wall with magnetic and/or electrical connections to an AC voltage source from a dual winding transformer.

(f) Induction Heating System: An induction heating system is a system in which heat is generated in a pipeline or vessel wall by inducing current and hysteresis effect in the pipeline or vessel wall from an external isolated AC field source.

(g) Skin Effect Heating System: A skin effect heating system is a system in which heat is generated on the inner surface of a ferromagnetic envelope attached to a pipeline and/or vessel. An electrically insulated conductor is routed through and connected to the envelope at the far end. The envelope and the electrically insulated conductor are connected to an AC voltage source from a dual winding transformer.

(h) Skin Effect Heating System: A skin effect heating system is a system in which heat is generated on the inner surface of a ferromagnetic envelope attached to a pipeline and/or vessel. An electrically insulated conductor is routed through and connected to the envelope at the far end. The envelope and the electrically insulated conductor are connected to an AC voltage source from a dual winding transformer.

(i) Application of Other Articles. All requirements of this Code shall apply except as specifically amended in this article. Cord-connected heating assemblies installed for specific uses and approved for the purpose shall be installed according to Article 422. Fixed electric pipeline and vessel heating equipment shall be calculated on the basis of 125 percent of the total load of the heaters.

B. Installation

427-10. General

(a) Equipment Type and Installation Requirements. Equipment for pipeline and vessel electrical heating shall be (1) of a type compatible with the chemical, thermal and physical environment; and (2) installed in accordance with the manufacturer's drawings and installation instructions.

(b) Equipment Design. Equipment for pipeline and vessel electrical heating shall be used within the limits for which it has been designed.

(c) Installation. Electrical heating equipment shall be installed in such a manner as to be afforded protection from physical damage.

(d) Thermal Protection. Accessible external surfaces of pipeline and vessel heating equipment operate at surface temperatures exceeding 60°C (140°F) shall be physically guarded, insulated or otherwise insulated to protect against contact by personnel in the area.

(e) Identification. The presence of electrically heated pipelines and/or vessels shall be evident by the posting of appropriate caution signs or markings at frequent intervals along the pipeline or vessel.

B. Installation


(a) Secured. Heating element assemblies shall be secured to the surface being heated by means other than the thermal insulation.

(b) Not in Direct Contact. Where the heating element is not in direct contact with the pipeline or vessel being heated, means shall be provided to protect against the heating element unless the design of the heater assembly is such that its temperature limitations will not be exceeded.

(c) Expansion and Contraction. Heating elements and assemblies shall not be installed where they bridge expansion joints unless provision is made for expansion and contraction.

(d) Flexural Capability. Where installed on flexible pipelines, the heating elements and assemblies shall have a flexible capability which will be in accordance with the temperature limitations of the heating elements.

(e) Power Supply Leads. Power supply nonheating leads (cold leads) for resistance elements shall be suitable for the temperature encountered. Preassembled nonheating leads on approved heaters may be shortened if the markings specified in Section 427-24 are retained. Not less than 6 inches of nonheating leads shall be provided with the fuse on box.

(f) Power Supply Leads Protection. Nonheating power supply leads shall be protected where they emerge from electrically heated pipeline or vessel heating units by raceway.

(g) Interconnection. Interconnection of nonheating leads connecting portions of the heating system shall be permitted to be covered by thermal insulation in the same manner as the heaters.


(a) Personal Protection. All accessible external surfaces of pipeline and vessel being heated shall be externally protected with insulation or other protection to prevent contact by personnel in the area.

(b) Voltage Limitations. The pipeline or vessel being heated and electrical connections to it shall not operate at a voltage greater than 30 volts AC. Exception No. 1: The voltage may be greater than 30 volts but not more than 80 volts if ground-fault sensing device with interrupting capability for personnel protection is provided.

(c) Grounding. The pipeline and/or vessel being heated which is operating at a voltage greater than 30 but not more than 80 shall be grounded at one end. Grounding shall be permitted to be provided with the fuse on box.

(d) Induced Currents. All current-carrying components shall be installed in accordance with Section 300-20.

(e) Isolation Transformers. A dual winding transformer with a grounded shield between the primary and secondary shall be used to isolate the distribution system from the heating system. Induction heating systems shall be designed to allow the installation of line frequency induction heating equipment and accessories for pipelines and vessels. See Article 685 for other applications.

(f) Personnel Protection. Induction coils and electrical connections to them which operate or may operate at a voltage greater than 30 volts AC shall be enclosed in a raceway, nonmetallic or split metallic enclosure, isolated or made weatherproof by location to protect personnel in the area.

(g) Induced Currents. Induction heating coils induced from circulating currents in surrounding metallic equipment, supports or structures by shielding, isolation or insulation of the current paths. All possible stray current paths shall be bonded to prevent arcing.

427-17. Skin Effect Heating.

(a) Grounding. The ferromagnetic envelope shall be grounded at both ends. The ferromagnetic envelope shall also be allowed to be grounded at intermediate points as required by its design.

(b) Conductor Amperage. The ampacity of the electrically insulated conductor inside the envelope shall not exceed the rating for which it was designed, rated and tested.

(c) Insulation. Power supply nonheating leads (cold leads) for resistance elements shall be provided with a positive lockout in the "off" position.

(d) Single Conductor in Enclosure. Section 410-20 shall be waived to allow installation of a single conductor in a ferromagnetic envelope (metal enclosure).

C. Construction and Protection


(a) Switch or Circuit Breaker. Means shall be provided to disconnect all fixed electric pipeline or vessel heating equipment from all ungrounded conductors. The branch-circuit switch or circuit breaker, where readily accessible to the user of the equipment, shall be permitted to serve as the disconnecting means. Means shall be of the indicating type, and shall be provided with a positive lockout in the "off" position.

(b) Cord-Connected Equipment. The factory-installed attachment plug of cord-connected equipment rated 20 amp or less and 150 volts or less to ground is an acceptable means of disconnecting.


(a) Temperature Control with "off" Position. Temperature controlled switching devices which indicate an "off" position and which interrupt current shall open all ungrounded conductors when the control device is in this "off" position. These devices shall not serve as a disconnecting means unless provided with a positive lockout in the "off" position.

(b) Temperature Control without "off" Position. Temperature controlled switching devices which do not indicate an "off" position and which interrupt current shall not serve as a disconnecting means.

(c) Remote Temperature Control. Remote controlled temperature actuated devices shall not be required to meet the requirements of Section 427-21 (a) and (b) above. These devices shall not serve as a disconnecting means.
(d) Combined Devices. Switching devices consisting of combined temperature and manually controlled switches which serve both as controllers and disconnecting means shall: (1) Open all ungrounded conductors when manually placed in the "off" position, (2) be so designed that the circuit cannot be energized automatically if the device has been manually placed in the "off" position, and (3) be provided with a positive lockout in the "off" position.

427-22. Overcurrent Protection. Equipment shall be protected against overcurrent in accordance with Section 210-20. Each factory-assembled heating unit shall be legibly marked within 3 inches of the end of each power supply lead with the permanent identification symbol, catalog number, and ratings in volts and watts, or in volts and amperes.

427-25. Electrical Connections.
(a) Nonheating Interconnections. Nonheating interconnections under the thermal insulation shall be made with properly installed insulated connectors approved for the purpose.
(b) Splice Connections and Terminations. Splice connections and terminations outside the thermal insulation shall be installed in a box or fitting in accordance with Sections 110-14 and 300-15.

427-26. Grounding. Exposed noncurrent-carrying metal parts of electric heating equipment which are likely to become energized shall be grounded as required in Article 250.

427-30. General. Induction and skin effect heating systems may be operated at voltages over 600 volts. Requirements for circuits and equipment operating at over 600 volts, nominal, are in Article 710.

SUBSTANTIATION: We are completing the scope of the relatively new Article 427, which at the present only covers resistance heating, by adding Induction heating, Induction heating and skin effect current tracing.

PANEL RECOMMENDATION: Accept as Revised:

ARTICLE 427—FIXED ELECTRIC HEATING EQUIPMENT FOR PIPELINES AND VESSELS

A. General

427-1. Scope. The requirements of this article shall apply to electrically energized heating systems and the installation of these systems used with pipelines and vessels.

427-2. Definitions. For the purpose of this article:
Pipeline. A length of pipe including pumps, valves, flanges, control devices, strainers and/or similar equipment for conveying fluids.
Vessel. A container such as a barrel, drum or tank for holding fluids or other materials.
Integrated Heating System. A complete system consisting of components such as pipelines, vessels, heating elements, heat transfer medium, thermal insulation, moisture barrier, nonheating leads with the permanent identification symbol, catalog number, and ratings in volts and watts, or in volts and amperes.
PPM Tubular heaters, strip heaters, heating cable, heating tape, heating blankets, immersion heaters are examples of resistance heaters.

427-16. Expansion and Contraction. Heating elements and assemblies shall be installed in accordance with Sections 110-14 and 300-15.

427-17. Flexural Capability. Where installed on flexible or rigid conduit, bell conduit, metal conduit, flexible metal conduit, or similar equipment, the heating elements and assemblies shall be flexible in accordance with Sections 110-14 and 300-15.

427-18. Power Supply Leads Protection. Nonheating power supply leads shall be protected where they emerge from electrically heated pipeline or vessel heating units by rigid metal conduit, intermediate metal conduit, electrical metallic tubing, or other raceways identified as suitable for the application.

427-26. Grounding. Exposed noncurrent-carrying metal parts of electric heating equipment which are likely to become energized shall be grounded as required in Article 250.

D. Impedance Heating

427-25. Personnel Protection. All accessible external surfaces of the pipeline and/or vessel being heated shall be physically guarded, isolated, or thermally insulated (with weatherproof covers for outside installations) to protect against contact by personnel in the area.

427-26. Voltage Limitations. The pipeline or vessel being heated shall not operate at a voltage greater than 30 volts ac.

Exception : The voltage shall be permitted to be greater than 30 volts but not more than 80 volts if a ground-fault circuit-interrupter for personnel protection is provided.

427-27. Isolation Transformer. A dual-winding transformer with a grounded shield between the primary and secondary windings shall be used to isolate the distribution system from the heating system.

427-28. Induced Current. All current-carrying components shall be installed in accordance with Section 427.

427-29. Grounding. The pipeline and/or vessel being heated which is operating at a voltage greater than 30 but not more than 80 shall be grounded at one designated point.

E. Induction Heating

427-35. Scope. This part covers the installation of line frequency induction heating equipment and accessories for pipelines and vessels.

PPM. See Article 665 for other applications.

427-36. Personnel Protection. Induction coils that operate or may operate at a voltage greater than 30 volts ac shall be enclosed in a nonmetallic or metal enclosure insulated or made inaccessible by lockout to protect personnel in the area.

427-37. Induced Current. Induction coils shall be protected from induced circulating currents in surrounding metallic equipment by shielding, isolation or other means as approved by the authority having jurisdiction.
Insulation of the current paths. Stray current paths shall be bonded to prevent arcing.

F. Skin Effect Heating

427-45. Conductor Amperage. The ampacity of the electrically-insulated conductor inside the ferromagnetic envelope shall be permitted to exceed the values given in Article 310 provided it is identified as suitable for this use.

427-46. Pull Boxes. Pull boxes for pulling the electrically-insulated conductor in the ferromagnetic envelope shall be permitted to be secured under the thermal insulation providing their locations are indicated by permanent markings on the insulation jacket surface and on drawings. For outdoor installations, pull boxes are to be watertight construction.

427-47. Single Conductor in Enclosure. The provisions of Section 300-20 shall not apply to the installation of a single conductor in a ferromagnetic enclosure.

(a) Grounding. The ferromagnetic envelope shall be grounded at both ends and, in addition, it shall be permitted to be grounded at intermediate points as required by its design. The ferromagnetic envelope shall be bonded at all joints to assure electrical continuity.

The provisions of Section 250-26 shall not apply to the installation of skin effect heating systems.

(FPN) See Section 250-26(d).

G. Control and Protection


(a) Switch or Circuit Breaker. Means shall be provided to disconnect all fixed electric pipelines or vessel heating equipment from all ungrounded conductors. The branch-circuit switch or circuit breaker, where readily accessible to the user of the equipment, shall be permitted to serve as the disconnecting means. Switches used as disconnecting means shall be of the indicating type, and shall be provided with a positive lockout in the "off" position.

(b) Cord-and-Plug Connected Equipment. The factory-assembled attachment plug of cord- and plug-connected equipment, rated 20 amperes or less and 150 volts or less, shall be permitted to be the disconnecting means.

427-56. Control and Protection.

(a) Temperature Control with "Off" Position. Temperature controlled switching devices which indicate an "off" position and which interrupt current when opened shall be permitted to serve as the disconnecting means.

(b) Temperature Control without "Off" Position. Temperature controlled switching devices which do not have an "off" position are not required to open all ungrounded conductors and shall not be permitted to serve as the disconnecting means.

(c) Remote Temperature Controller. Remote controlled temperature actuated devices shall not be required to meet the requirements of Section 427-56(a) and (b) above. These devices shall not be permitted to serve as the disconnecting means.

(d) Combined Switching Devices. Switching devices consisting of combined temperature actuated devices and manually controlled switches which serve both as the controllers and the disconnecting means shall comply with all the following conditions:

1. Open all ungrounded conductors when manually placed in the "off" position, and
2. Be so designed that the circuit cannot be energized automatically if the device has been manually placed in the "off" position, and
3. Be provided with a positive lockout in the "off" position.

427-57. Overcurrent Protection. Heating equipment shall be considered as protected against overcurrent where supplied by a branch circuit as specified in Section 427-4.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

427-4: Change first sentence to read "The ampacity of branch-circuit conductors supplying fixed electric pipeline and vessel heating equipment shall be in accordance with Section 240-3, Exception No. 1 and Section 210-22(c) where applicable. See Explanation for Vote on Proposal No. 19.

Section 427-26, Exception: The use of the words "for personnel protection" although not defined by the NEC, may imply to inspectors a 5.0 ampere device. Those devices would be operative on an impedance heating circuit since there is more leakage current than 5 mA. What is intended is a GFCI as defined by the NEC which would operate at a lower current to ground than the circuit protective device. I recommend those words be deleted. See Section 680-41(a) for a precedent.

Section 427-29: Delete "one" and add (S) at end of sentence to agree with panel decision and Section 426-34.

Section 426-34(a): This should be renumbered 427-48 to agree with panel decision and format established in Section 426-44.

JORDAN: The following comments are editorial:

1. In Section 427-4: Change wording to conform with Proposal No. 19, to assure consistency.

2. In Section 427-12: Second sentence; delete word "surface," which is redundant.

3. In Section 427-16: Third line; make "provision" plural and change word "is" to "are." In Section 427-56(c): First sentence, third line: Change "(b) above" to read "Section 427-55(b)."

427-1 (1978 NEC): Reject

SUBMITTER: Manufacturing Chemists Association

PROPOSAL: 48 Delete the second sentence of 427-1.

SUBSTANTIATION: There is a need for recognition of all types of electrical heating in common use today in industry. There are five methods of electrical heating:

(1) Impedance heating-current flow through the pipeline or vessel wall as an impedance;
(2) Induction heating-current induced into the pipe by induction; (3) Skin effect-current flow confined by skin effect to the inner wall of a tubular steel element welded to or inside the pipeline; (4) External heating with a heating cable, heating tape, strip heaters, tubular heaters, heating blankets, etc.; (5) Internal heating with a heating cable, tubular heaters, immersion heaters, etc., or by electrically-powered circulating heaters.

The fifth line of 427-1 specifically excludes two types of electrical heating. These should be recognized.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

427-2: Accept

SUBMITTER: Pipeline Heating Systems, Brecksville, OH

PROPOSAL: 49 Revise the ending of second sentence to read after the comma, "other than the impedance method."

SUBSTANTIATION: Same as Proposal No. 62 to 1978 Preprint.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

427-3: Accept

SUBMITTER: Claude E. Deering, Jr., American Petroleum Institute

PROPOSAL: 50 Add the word "classified" in parenthesis after the word "hazardous." This is consistent with Article 500, which is entitled "Hazardous (Classified) Locations." The proposed wording recognizes that a location is not hazardous per se, but is classified depending on the properties of the flammable or combustible substance which may be present, and the likelihood that a flammable or combustible concentration or quantity will be present.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

427-4: Reject

SUBMITTER: Warren H. Cook, IEEE

PROPOSAL: 52 Change reference from Article 422 to Article 400.

SUBSTANTIATION: Article 422 deals with appliances while Article 400 is flexible cords and cables.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

427-4: Reject

SUBMITTER: Warren H. Cook, IEEE

PROPOSAL: 53 Revise 427-4 to read: The minimum size of branch-circuit conductors supplying fixed electric pipeline and vessel heating equipment shall be calculated on the basis of 125 percent of the total load of the heaters. The size of branch-circuit overcurrent protective devices supplying fixed electric pipeline and vessel heating equipment shall be calculated on the basis of 125 percent of the total load of the heaters. If there is a ground fault, the service disconnect shall be able to clear it.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ERICKSON: Although I agree with panel action on this proposal I would like to comment on certain sections.

Section 427-4: Change first sentence to read "The ampacity of branch-circuit conductors supplying fixed electric pipeline and vessel heating equipment shall be in accordance with Section 240-3, Exception No. 1 and Section 210-22(c) where applicable. See Explanation for Vote on Proposal No. 19.

Section 427-26, Exception: The use of the words "for personnel protection" although not defined by the NEC, may imply to inspectors a 5.0 ampere device. Those devices would be operative on an impedance heating circuit since there is more leakage current than 5 mA. What is intended is a GFCI as defined by the NEC which would operate at a lower current to ground than the circuit protective device. I recommend those words be deleted. See Section 680-41(a) for a precedent.

Section 427-29: Delete "one" and add (S) at end of sentence to agree with panel decision and Section 426-34.

Section 426-34(a): This should be renumbered 427-48 to agree with panel decision and format established in Section 426-44.
equipment shall be calculated on the basis of 125 percent of the total load current when used for heating purposes.

**SUBSTANTIATION:** Use of a minimum requirement for overcurrent protection of branch-circuits could lead to ground currents for extended periods of time. The panel was supplied with a typical circuit of a pipe tracing circuit.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** The present wording adequately reflects the panel's intent.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**COMMENT ON VOTE:** ERIKSON: Although I agree with the panel action on this specific proposal, I also agree with the intent of the proposal. Mr. Cook desires to have minimum sized branch-circuit overload protection to provide the best possible ground-fault protection for resistance heating loads. See comments on Proposal 47 for a suggested solution.

427-12(g)-(New)(HOD 1978 NEC): Reject

**SUBMITTER:** Manufacturing Chemists Association

**PROPOSAL:** 54

**(g)** Where a pipeline or vessel wall is used as the heating element, the pipeline or vessel shall conform to the following: (1) thermally insulated for safety of personnel; (2) electrically insulated from supporting structures; (3) protected from physical contact by suitable guards or by location; (4) visibly marked as being electrically energized; (5) voltage-to-ground of the pipeline or vessel shall be below 50 volts (6) circuit-grounded or system-grounded in accordance with Section 250-5(a).

**SUBSTANTIATION:** There is no need to recognize installation of equipment used in industry but not previously considered in the NEC. This type of heating has been practiced successfully by industry for many years. The combination of all types of pipeline and vessel heating into a single article is highly desirable.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See action on Proposal No. 47.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**COMMENT ON VOTE:** ERIKSON: I feel the Panel Comment should be changed to "CMP agrees with intent of proposal." See action on Proposal No. 47.

427-23(a): Accept

**SUBMITTER:** Warren H. Cook, IEEE

**PROPOSAL:** 55

**(a)** "and shall be supplied by the heating element manufacturer."

**SUBSTANTIATION:** The National Electrical Code should address itself to safety and source of supply.

**PANEL RECOMMENDATION:** Accept.

**PANEL COMMENT:** See Proposal No. 47.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

**NEGATIVE:** Eichhorn.

**EXPLANATION OF VOTE:** EICHORN: Section 427-23(a). As in Proposal 45, the concern is about general approval for field connection of power supply leads to the heating element. It is suggested that existing Section 427-23(a) be used for Section 427-14(a) with this added. Exception: "Field connection of power supply nonheating leads (cold leads) to the electric heating elements shall be permitted where the means of connection is identified as suitable for this purpose."

Section 427-20(b). The words "attachment plug of" were omitted between "factory installed" and "and plug-connected equipment."

427-23(b), Exception (New): Reject

**SUBMITTER:** Warren H. Cook, IEEE

**PROPOSAL:** 56

**Exception:** Metal conduit or metallic tubing shall not be required for cord connected equipment when adequately protected by other means.

**SUBSTANTIATION:** The placement of heating wire directly on the vessel to be heated requires a flexible, open connection between the heating wire and the raceway system. This flexible open connection has been found to be satisfactorily and suitably made by extending the cold leads in protected manner from the heated component to a fitting of the raceway system. A suitable length has been found to be 18 inches maximum.

**PANEL RECOMMENDATION:** Reject.

**PANEL COMMENT:** See panel action on Proposal No. 47.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

427-25: Accept

**SUBMITTER:** TCS-Approved for the Purpose

**PROPOSAL:** 57

See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
known, and is part of the design.

427-30. Self explanatory.

427-31. Skin effect tracing systems should be grounded at one point, even though they are universally directly mounted on grounded pipes or vessels. Even in the unlikely occurrence of an ungrounded pipe and a broken ground wire, there will be no harmful closed circuits if contacted by personnel or conducting material.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: CMP agrees with the intent of the Proposal. See action on Proposal No. 47.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 430 -- MOTORS, MOTOR CIRCUITS, AND CONTROLLERS

Diagram 430-1: Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 1

CHANGE: Motor Feeder Overcurrent Protection TO READ: Motor Feeder Short-Circuit and Ground Fault Protection.

CHANGE: Motor Branch-Circuit Overcurrent Protection TO READ: Motor Branch-Circuit Short-Circuit and Ground Fault Protection.

CHANGE: Motor Overload Protection.

CHANGE: Inherent Protection TO READ: Thermal Overload Protection.

SUBSTANTIATION: Related editorial revisions for the following:


Editorial revision of Articles 430 and 440 of the 1975 NEC were for clarification of the terms - overload, overcurrent, and short-circuit and ground-fault protective device. Since not all the changes require the move of related proposals are admitted to complete the editorial changes and preserve the intent for the terms "overload," "overcurrent," and "short-circuit and ground-fault." 

This follows where the editorial revisions in the 1975 NEC confirmed that "overload (for motors)" in Article 430 means current due to overload and failure to start and excludes fault currents caused by short circuit and ground fault. The editorial revisions in the 1975 NEC replaced references to "motor running overloads" and "motor running overcurrent" with the term "motor overload," wherever it was the intent that the currents involved were due to both overload and failure to start.

Additionally, the motor branch circuit protective device such as in Part D was renamed as intended for protection against only short-circuit and ground-fault currents and excludes overcurrent loads. In contrast, the term, "overcurrent," includes any current resulting from short circuit, overcurrent, and ground fault. The editorial revisions in the 1975 NEC intended to use the term, "short-circuit and ground-fault protective device" in place of the term, "overcurrent," wherever it was the intent that only fault currents were involved due to short circuit and ground.

PANEL RECOMMENDATION: Accept as Revised:

The same editorial changes required by this Proposal are also required in additional sections of Articles 430 and 440 as follows:

- 430-3. In paragraph 2 line 1 delete the words "running overload and replace with the word "overload."

- 430-6 (a). In line 4 delete the words "overcurrent devices" and replace with the words "short-circuit and ground-fault protection."

- In lines 6 and 7 delete the words "motor-running overcurrent" and replace with the words "motor overload."

- 430-6 (b). In lines 4 and 5 delete the words "motor running overcurrent" and replace with the words "motor overload."

- 430-6 (c). In lines 3 and 4 delete the words "overcurrent devices" and replace with the words "short-circuit and ground-fault protection."

- 430-7 (b). In line 6 delete the word "overcurrent" and replace with the words "short-circuit and ground-fault." 

- 430-7 (d). In lines 5 and 8 delete the word "overcurrent" and replace with the words "short-circuit and ground-fault protective."

- 430-8. In lines 4 and 6 delete the words "motor-running overload" and replace with the words "motor overload."

- In line 7 delete the word "overcurrent" and replace with the words "short-circuit and ground-fault." 

- 430-50. In line 2 insert the words "short-circuit and ground-fault" after the words "branch-circuit."

Paragraph (b) (1) line 2 insert the words "branch-circuit short-circuit and ground-fault" after the words setting of the. Paragraph (b) (2) Insert the words "branch-circuit short-circuit and ground-fault" after the words setting of the. Paragraph (b) (2) Exception No. 1 line 4 delete the word "circuit" after the maximum and replace with the words "branch-circuit short-circuit and ground-fault."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
430-5: Accept  
SUBMITTER: Larry T. Smith and LaVerne E. Stetson, Lincoln, NB  
NOTE: Add a sentence before the last sentence of the proposal:

"The change is to remove unintended permission for a crossover of marked limits. Although Section 430-3(c)(4) permits the rating of the fuse or circuit breaker to be increased to the next standard rating higher than the calculated minimum, and/or may be less than the calculated maximum. Under the present rules, the marked maximum rating of the overcurrent device (fuse or circuit breaker) could be less than the marked minimum. The matching of the locked rotor characteristics of motors and overload relay protective devices is an important part of motor protection that is not yet covered in the NEC."

PROPOSAL: Add a sentence before the last sentence of the proposal:

"The change is to remove unintended permission for a crossover of marked limits. Although Section 430-3(c)(4) permits the rating of the fuse or circuit breaker to be increased to the next standard rating higher than the calculated minimum, and/or may be less than the calculated maximum. Under the present rules, the marked maximum rating of the overcurrent device (fuse or circuit breaker) could be less than the marked minimum. The matching of the locked rotor characteristics of motors and overload relay protective devices is an important part of motor protection that is not yet covered in the NEC."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-7(a)(14)-(New): Reject  
SUBMITTER: Marvin T. Stevens, Greenbale, WI  
PROPOSAL: Add a sentence before the last sentence of the proposal:

"We believe the marked overload relay class should be the maximum class, in accordance with Proposal No. 9."

EXPLANATION OF VOTE:

LOPEZ: I disagree with the Panel's Recommendation since I believe this proposal will improve the motor overload protection. The marking of overload relay class on the motor nameplate will help the users with the selection of the proper overload relay to utilize.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-7(d): Reject  
SUBMITTER: Richard J. Denny, Air Conditioning & Refrigeration Institute  
PROPOSAL: Add a sentence before the last sentence of the proposal:

"We believe the marked overload relay class should be the maximum class, in accordance with Proposal No. 9."

EXPLANATION OF VOTE:

SCHRAM: While we agree a design consideration is involved, it is the design of the marking. We do not believe the Code should permit a marking which in conflict with the intent, as stated in the proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-7(d): Reject  
SUBMITTER: Alton R. Thompson, Durham, NC  
PROPOSAL: Add a sentence before the last sentence of the proposal:

"We believe the marked overload relay class should be the maximum class, in accordance with Proposal No. 9."

EXPLANATION OF VOTE:

SCHRAM: While we agree a design consideration is involved, it is the design of the marking. We do not believe the Code should permit a marking which in conflict with the intent, as stated in the proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

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VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
where the conductor termination means (lugs) supplied by the manufacturer of a listed motor controller are replaced by other conductor termination means, conductors shall not be deflected at a terminal unless bending space in accordance with Table 430-10 is provided. And add a new table as follows:

Table 430-10. Minimum Wire Bending Space at Terminals in Inches

<table>
<thead>
<tr>
<th>Size of Wire</th>
<th>Circular-Mil</th>
<th>Wires per Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>4/0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>750 MCM</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>750 MCM</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>750 MCM</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>900 MCM</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

Bending space at terminals shall be measured in a straight line from the end of the lug or wire connector (in the direction that the wire leaves the terminal) to the wall or barrier.

SUBSTANTIATION: The conductor termination means furnished with motor controllers are evaluated as part of the controller in order to obtain listing by a nationally recognized testing laboratory. Most installing electricians are not aware that changing the termination of a controller nullifies this listing. Experience has shown that the series type lugs furnished with listed motor controllers are occasionally replaced with crimp type lugs at the time the controllers are installed even though the replacement lugs may not include an anti-rotation feature which the original termination had. When the individual making the installation uses a listed lug as a replacement with no concern for its length, he can create a situation where the wiring space is not adequate and the conductors are subject to damage as they are forced between the end of the lug and the wall of the enclosure. In addition, inadequate wiring space may lead to improper orientation of the new lugs with a resulting loss of electrical clearance. Since nationally recognized testing laboratories list lugs with no constraint on their length, and only a small percentage of all motor controllers manufactured are used with lugs other than those furnished, there is no practical way for a controller manufacturer to anticipate the wiring space that may be required under changed lug conditions. The individual choosing to change the conductor termination should be made responsible for proper lug selection.

Proposed Table 430-10 is based on the table recommended by Underwriters Laboratories as a result of a fact-finding investigation suggested by CMP 11 regarding adequate wiring space in enclosures for motor controllers.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 430-10(8). Minimum Wire Bending Space at Terminals of Enclosed Motor Controllers in Inches

<table>
<thead>
<tr>
<th>Size of Wire</th>
<th>Circular-Mil</th>
<th>Wires per Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>4/0</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>750 MCM</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>750 MCM</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>900 MCM</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

SUBSTANTIATION: The conductor termination means furnished with motor controllers are evaluated as part of the controller in order to obtain listing by a nationally recognized testing laboratory. Most installing electricians are not aware that changing the termination of a controller nullifies this listing. Experience has shown that the series type lugs furnished with listed motor controllers are occasionally replaced with crimp type lugs at the time the controllers are installed even though the replacement lugs may not include an anti-rotation feature which the original termination had. When the individual making the installation uses a listed lug as a replacement with no concern for its length, he can create a situation where the wiring space is not adequate and the conductors are subject to damage as they are forced between the end of the lug and the wall of the enclosure. In addition, inadequate wiring space may lead to improper orientation of the new lugs with a resulting loss of electrical clearance. Since nationally recognized testing laboratories list lugs with no constraint on their length, and only a small percentage of all motor controllers manufactured are used with lugs other than those furnished, there is no practical way for a controller manufacturer to anticipate the wiring space that may be required under changed lug conditions. The individual choosing to change the conductor termination should be made responsible for proper lug selection.

Proposed Table 430-10 is based on the table recommended by Underwriters Laboratories as a result of a fact-finding investigation suggested by CMP 11 regarding adequate wiring space in enclosures for motor controllers.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
UL fact-finding investigation indicates that this is an important factor which facilitates wire installation. 3. In the wire range of 2/0AWG to 3/0AWG, most motor control installations use copper wire. The UL fact-finding investigation indicates that copper wire is easier to manipulate. Further, a smaller size copper wire is generally used for the equivalent ampacity rating of aluminum wire. 4. Motor controllers are designed to permit the addition of accessories such as control transformers, auxiliary contacts, pushbuttons, selector switches, pilot lights, etc., which result in oversize enclosures for many applications. 5. Since motor controllers are not permitted to be used as junction boxes by the NEC, only one wire per terminal need be considered for wire sizes 2/0AWG and smaller. 6. Motor controllers are generally easily removed from their enclosures which can improve access to the wire connectors and facilitate the connection of wires to the controller. The controller can be fastened to the wire and reassembled to the controller.

*** Adj. (a) General. ***

A fact-finding investigation by a nationally recognized testing laboratory has indicated a need to specify wire bending space requirements in Article 430. However, it is recognized that many motor control centers, which have some design elements similar to control centers, which have some design elements similar to motor controllers, in a manner consistent with the treatment proposed for Article 373. SCHRAM: An affirmative vote is cast to support the addition of bending space requirements in Article 430. However, it should be noted that the proposal differs in several respects from the proposals being considered in Article 373. Table 430-11(b) is based on this, the section would be better not less than 1.5 inches.

**ATTACHMENT A**

<table>
<thead>
<tr>
<th>Horsepower</th>
<th>Three Phase</th>
<th>Maximum</th>
<th>Three Phase</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>105</td>
<td>4.2</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>165</td>
<td>5.4</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>240</td>
<td>7.0</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>3000</td>
<td>375</td>
<td>9.3</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>4000</td>
<td>500</td>
<td>10.7</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>5000</td>
<td>900</td>
<td>15.0</td>
<td>2000</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENT ON VOTE:**

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

### Table 430-12(b)(1)

<table>
<thead>
<tr>
<th>Alternating-Current Motors</th>
<th>Over 11 Inches in Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Full-load Current</td>
<td>Terminal Box</td>
</tr>
<tr>
<td>For Three Phase Motors</td>
<td>Box</td>
</tr>
<tr>
<td>Amperes</td>
<td>Cubic Inches</td>
</tr>
<tr>
<td>45</td>
<td>2.5</td>
</tr>
<tr>
<td>70</td>
<td>3.3</td>
</tr>
<tr>
<td>110</td>
<td>4.2</td>
</tr>
<tr>
<td>160</td>
<td>5.4</td>
</tr>
<tr>
<td>250</td>
<td>7.0</td>
</tr>
<tr>
<td>400</td>
<td>9.3</td>
</tr>
<tr>
<td>600</td>
<td>10.7</td>
</tr>
<tr>
<td>800</td>
<td>15.0</td>
</tr>
</tbody>
</table>

**SUBSTANTIATION:**

Most users of motors find the terminal box size insufficient for all the wires and splices and from the necessity for oversize bending of the wires. Both of these contribute to physical overstressing of the insulation which results in inordinate failure rates of conductors in the terminal boxes. It has been found that one-quarter of all "motor" failures occurred in the terminal boxes. Table 430-12(b)(2) is based on this, the section would be better not less than 1.5 inches.

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<td>3.3</td>
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<tr>
<td>110</td>
<td>4.2</td>
</tr>
<tr>
<td>160</td>
<td>5.4</td>
</tr>
<tr>
<td>250</td>
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<tr>
<td>400</td>
<td>9.3</td>
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<tr>
<td>800</td>
<td>15.0</td>
</tr>
</tbody>
</table>
PANEL RECOMMENDATION: Reject.

- Ventilation and Maintenance. Motors shall be accessible for making these bends and splices without exceeding the bending sharpness specified in Sec. 373-6.
- First two Tables on page 292 in the 1978 NEC to be shown as in Attachment A. Also in Attachment A, Table 430-12(b)(1), column 3 entitled "Usable Volume Minimum Cubic Inches," change fourth figure down from "120" to "180." In same Table, column 2 entitled "Terminal Box Minimum Dimensions," change the following: from "3.0" to "4.0," "5.4" to "6.0," "9.3 to "10.7" and "8.6" to "9.0." In Table 430-12(b)(2), column 2 entitled "Terminal Box Minimum Dimensions" change the following: from "4.2" to "5.4," "6.0" to "7.2," "9.3 to "10.7." In Table 430-12(b)(3), column 4 entitled "Usable Volume Minimum Cubic Inches," change third figure down from "100" to "100." 

- VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 17 Change "volts" in the left column heading to read "Watts," change "amperes" to "amps," and second line of the first column "over 240 through 600," change third figure down from "4.2" to "4.0," second and third lines of the second column "250-113 shall be provided at motor terminal boxes for equipment grounding connections. Equipment grounding connections shall be permitted to be located in the motor terminal housing during equipment installation, a separate means for such connections or fittings as required by Section 250-113 shall be provided at motor terminal boxes. Such devices or fittings shall be located so that the equipment grounding connection device or fitting should read "240 or less" and second line of the first column "over 240 through 600."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 18 Add a section (e) to Section 430-12.

- Equipment Grounding Connections. Equipment grounding connection devices or fittings as required by Section 250-113 shall be provided at motor terminal housings. Such devices or fittings shall be located so that the equipment grounding conductor may be terminated either inside or outside the motor terminal housing.
- Termination fittings for grounding conductors shall not be provided at motor terminal housings. Use of the cap screws that fasten the motor terminal housing to the motor is a violation of Section 250-114(a). The connection device or fitting should be installable for use inside or outside the motor terminal housing. This would then be compatible with the permissive methods of Section 250-79(e) Installation-Equipment Bonding Jumper.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: A. P. White, Atteboro, MA

PROPOSAL: 21 In the last paragraph, delete the words "motor-running" and replace with the word "motor."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: A. P. White, Atteboro, MA

PROPOSAL: 22 Revise the second paragraph to read as follows:

"Panel-circuit conductors supplying a single "AC" motor, or a DC motor operating from a source other than a rectified single-phase AC supply, shall have an ampacity not less than 125 percent of the motor full-load current rating. Add the following new paragraph between the existing second and third paragraph (retain the existing paragraph entitled "Exception" as the fourth paragraph):
In case of direct-current motors operating from a single-phase power supply, the conductors between the controller and the motor shall have an ampacity not less than the following percent of the motor full-load current rating given in Table 430-147:
1. Where a rectifier bridge of the single-phase half-wave type is used, 190 percent.
2. Where a rectifier bridge of the single-phase full-wave type is used, 150 percent.

- SUBSTANTIATION: This proposal recognizes the existence of significant form factors for integral-horsepower motors operating from single-phase power supplies and the need to select conductors on the basis of rms current rather than the basis of average current. CMP-11 may wish to editorially restructure this section for any clarity believed necessary to incorporate the intent of the proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: A. P. White, Atteboro, MA

PROPOSAL: 23 Delete the words "parasitic" and "causing" from paragraph E-1 of Article 430.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: J. J. Kark, National Electrical Manufacturers Association

PROPOSAL: 24 Revise as follows:

"Where a rectifier bridge of the single-phase half-wave type is used, 190 percent.
2. Where a rectifier bridge of the single-phase full-wave type is used, 150 percent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: A. P. White, Atteboro, MA

PROPOSAL: 25 In the last paragraph, delete the words "HEAT..." and replace with the word "motor."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: A. P. White, Atteboro, MA

PROPOSAL: 26 In the last paragraph, delete the words "HEAT..." and replace with the word "motor."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-32(b)(1), Exception: Accept

SUBMITTER: A. P. White Atteboro, MA

PROPOSAL: 27 Delete the reference to "Section 430-32 (a)(1)."

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-32: Reject

SUBMITTER: Charles B. Kish, The Travelers Insurance Co.

PROPOSAL: 28 In the 4th line replace the comma with "of the motor if the

SUBSTANTIATION: See related proposals for Section 430-7(a),

PANEL RECOMMENDATION: Accept.

PANEL COMMENT: Proposal is a design consideration, vote on panel recommendation: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-35(a): Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 29 Delete the word "running" in line 2.

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-35(b): Accept

SUBMITTER: Roger C. Troupe, Fremont, NE

PROPOSAL: 30 Amend section to read: Nonautomatically started

SUBSTANTIATION: See related proposals for Section 430-7(a),

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
430-37: Accept
SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL: 32 Delete the word "running" in line 2.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 430-37: Accept
SUBMITTER: A. P. White, Attleboro, MA-
PROPOSAL 33 Delete the word "running" in the title.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-38: Accept
SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL 34 Delete the word "running" in line 2.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-39: Accept
SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL 35 Delete the word "running" in line 2.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept as Revised.
Also delete "Running" in title.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-40: Accept
SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL 36 Delete the word "running" in line 2.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-40-(New): Reject
SUBMITTER: Marvin T. Stevens, Greendale, WI
PROPOSAL: 38 Revise as follows:
(a) Thermal Cutouts and Overload Relays.
(b) Overload Relay Class Designation. An overload relay for the current element selection table that is provided where the overload relay includes replaceable current elements (heaters), shall be marked with its class designation.
Fine print note: Definition: The class designation of an overload relay is a number that indicates the maximum time (in seconds) in which the overload relay will function when carrying a current equal to 600 percent of its current rating.
Fine print note: Definition: The current rating of an overload relay is the minimum value of continuously applied current that is expected to cause all like relays to function (trip) under designated conditions. This value, for an individual relay, may equal or exceed its ultimate trip current under these conditions.
SUBSTANTIATION: Related proposals have been submitted (1) to REVISED SECTION 430-34 to provide the means by which a user selects the overload relay that has "sufficient capacity to permit the motor to start and accelerate the load" and (2) to add a maximum overload relay class designation to the motor nameplate (430-7-4A). All three proposals should be considered as a package.
The overload relay class designation system offers a way to provide better running overload protection for motors without increasing manufacturing or installation costs.
PANEL RECOMMENDATION: Reject.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-41-(New): Reject
SUBMITTER: Kenneth L. Paape, Allen-Bradley Co., Milwaukee, WI
PROPOSAL: 39 Add new section as follows:
430-41. Overload Relay Classes. Overload relays or controllers which include overload relays shall be marked on the overload relay selection table that is furnished with the overload relays, showing the class designation on the table shall be permitted.
SUBSTANTIATION: For many years Underwriters Laboratories had a performance requirement in their standard for Industrial Control (UL503) that required each overload relay to trip at 600 percent of its current rating within 30 seconds. The current rating of an overload relay is that current which when continuously applied to the relay will ultimately cause it to trip under designated conditions. This value, for an individual relay, may equal or exceed its ultimate trip current under these conditions.
STANDARDS: For many years Underwriters Laboratories had a performance requirement in their standard for Industrial Control (UL503) that required each overload relay to trip at 600 percent of its current rating within 30 seconds. The current rating of an overload relay is that current which when continuously applied to the relay will ultimately cause it to trip under designated conditions. This value, for an individual relay, may equal or exceed its ultimate trip current under these conditions.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

EXPLANATION OF VOTE:
CANNADAY: I wish to register my vote negative on Proposal No. 37 since this would require a marking that is presently permitted. It should not be required at this time since it will mislead those in the field and become a requirement for inspection where it is intended only to supply information.
MIERENDORF: Proposal No. 37 deals with the important subject of component coordination with short circuit protective devices under short circuit conditions.
Information regarding I2t and Ip let-through values for short circuit protective devices for a range of values of short circuit currents is not yet available.
Because of application problems inherent when information is incomplete, this proposal is not yet appropriate for inclusion in the Code.
WHITE: Such practice is not prohibited by the present Code and application problems are involved which make this proposal inappropriate for the NEC.
WOOD: This proposal should be rejected as this practice is not presently prohibited by the Code. It is improbable that the installer will have sufficient information at the job-site to properly implement this type of requirement.

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match the reduced thermal overload capability of T-frame motors. Too many motors were burning out under locked rotor conditions with the 30 second maximum overload relay design. Consequently motor manufacturers recognized that some of their motors, particularly those associated with air conditioning and refrigeration equipment had even shorter permissible locked rotor time and they demanded from the control industry a line of overload relays that were called "Fast Tripping." Meanwhile, original equipment manufacturers and industrial users who had high inertia loads attached to their motors realized that very often the new 20 second maximum overload relay was too fast and would trip out before the motor and its high inertia load came up to speed. They needed a line of "Slow Tripping" overload relays.

A few years ago Underwriters Laboratories, in conjunction with representatives of the control industry, developed the concept of class designations for overload relays. These class designations are in the NEMA Standard for Industrial Control (ICS-1970) and UL508. The essence of the class designation is the maximum time (in seconds) in which the overload relay must operate when subjected to a current equal to 600 percent of its rating. The end result is Class 10, Class 20, and Class 30 overload relays are available today in today's marketplace. Any one of them can be used for a given full load motor current. Thus for any one motor full load current a user can select any one of 3 relays, each with the same current rating, but a different class designation. Under continuous overload conditions all 3 relays will ultimately trip at the current equal to their common rating, but their response time to locked rotor or a longer start period is dramatically different.

Attached are the time-current characteristics of the 3 classes of relays, each having the same maximum ultimate trip characteristic as the 430-32 for a service factor 1.0, 1.2, and 1.5 motor. Also shown on the attachment is a tabulation of the marked decrease in insulation life as a result of subjecting the motor windings to overtemperature. Note that current is expressed as multiples of motor full-load current, not multiples of relay ratings.

Section 430-34 recognizes the problem of bringing a motor and its associated high inertia load up to speed by permitting an increase in the protection factor under such conditions to 130 percent of motor full-load current for a service factor 1.0 motor. We believe that there is less danger of motor burnout and hence a reduced fire hazard if instead of moving to an overload relay with higher ultimate trip current as provided by Section 430-34, the user would select a higher class designation overload relay. In this way he could obtain more locked rotor time without sacrificing protection under running conditions. We felt that the way to start was to add class designations for overload relays in 2 places in the Code; first a new section proposed, as 430-41, secondly under device marking requirements (430-7). We felt that motor manufacturers and manufacturers of motor driven equipment would both know the overload capability and its inertia of their equipment and thus be the most qualified to select the class of overload relay that provides optimum protection for the motor and yet precludes the nuisance tripping which necessitated Section 430-34. It was our hope that once proposals such as we have submitted for Sections 430-7(a) and 430-41 were incorporated into the Code, consideration could be given to modifying Section 430-34 in some way so as to solve the problem of nuisance tripping without sacrificing running overcurrent protection.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-42(a): Accept

SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL: 40 Delete the words "running" in line 2.

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-42(a) and (b): Reject

SUBMITTER: Warren Anderson, Mount Vernon, WA

PROPOSAL: 41 Delete 430-42(a) and (b) and relocate (c) and (d) to Section 430-53.

SUBSTANTIATION: A. P. White (as listed above) but not (3). This is a direct conflict. Also the overload protection as stated in Section 430-53 is essential and clearly defined in the code. Panel Recommendation: Reject.

C. Summary:

1. Eliminate Section 430-42(a).
2. Eliminate Section 430-42(b).
3. Move Section 430-42(c) and (d) to 430-53.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-42(b): Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 42 Delete the word "running" in lines 3 and 5.

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-42(c): Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 43 Delete the word "running" in line 3 and 8.

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-42(d): Accept

SUBMITTER: CMP 11

PROPOSAL: 44 Add a new sentence between second and third sentences of the first paragraph reading: "The devices specified in Part D do not include the types of devices required by Sections 210-8 and 230-95."

SUBSTANTIATION: Official Interpretation No. 75-1.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-43: Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 45 Delete the word "running" in line one.

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-51: Accept

SUBMITTER: CMP 11

PROPOSAL: 46 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-52: Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 47 Delete the words "branch-circuit." in lines 2 and 7.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-55: Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 48 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
(1) Delete third paragraph and make wording of third paragraph Exception No. 1 to first paragraph. Delete Exception under existing third paragraph and change as new Exception No. 2 to first paragraph, as follows: "Exception No. 2: Where the rating specified in Table 430-152 is not sufficient for the starting current of the motor, a. (same as (a) of existing Exception). b. (same as (b) of existing Exception). c. (same as (e) of existing Exception). d. (same as (f) of existing Exception). Make new Exception No. 3 to first paragraph, same as Item (d) of existing Exception. Make new Exception to second paragraph as follows: "Exception: Where the setting specified in Table 430-152 is not sufficient for the starting current of the motor, the setting of an instantaneous trip circuit breaker shall be permitted to be increased but shall in no case exceed 1200 percent of full-load current.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-52: Accept

SUBMITTER: Joseph L. Yosafat, General Electric Co.

PROPOSAL: 47 Add a new paragraph at end of 430-52 as follows: Suitable fuses shall be permitted in lieu of devices listed in Table 430-152 for an adjustable speed drive system provided that the marking for replacement fuses is provided adjacent to the fuses.

SUBSTANTIATION: Fuses now recognized by the Code for short circuit protection for adjustable speed drives provide inadequate protection for the drive semiconductors. As semiconductors have very small thermal capacities, very fast acting energy limited fuses are required. These same fuses provide adequate short circuit protection for other devices in the branch circuit as these other devices have larger thermal capacities as demonstrated by the time current tests. These fuses are used only for short circuit protection and are coordinated with other approved means for providing overload protection, protection is provided by the adjustable speed drive system. Marking will assure that the replacement fuses provide the fast protective action required.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

EXPLANATION OF VOTE:

WHITE: This proposal should be rejected because it is incomplete and confusing. The proposed format is faulty where it does not include a requirement for maximum permissible fuse rating as is done in the other exceptions. Additionally, there is no reason to limit this proposal to a controller having overload and also short-circuit and ground-fault protection in each conductor. The combination provides coordinated motor branch circuit overload and short-circuit and ground-fault protection.

NEGATIVE: Yellow

EXPLANATION OF VOTE:

YELLOW: This proposal should be accepted as Revised:

Add a new paragraph at the end of 430-52 as follows:

For an adjustable speed drive system, special purpose fuses for protection of semiconductors shall be permitted in lieu of devices listed in Table 430-152, provided that:

(a) The fuse(s) is part of a controller having motor overload and also short-circuit and ground-fault protection in each conductor.

(b) The combination provides coordinated motor branch circuit overload and short-circuit and ground-fault protection.

(c) Marking for replacement fuses is provided adjacent to the fuses.

VOTE ON PANEL RECOMMENDATION: Unanimously Negative.

430-52: Exception Nos. 2 and 3: Reject

SUBMITTER: Kenneth L. Paape, Allen-Bradley Co.

PROPOSAL: 50 Add new exceptions as follows:

"Exception No. 2: Where the motor full-load current is less than 3.75 amperes in a polyphase motor circuit, the setting of an instantaneous trip circuit breaker shall not exceed 400 percent of the full-load current."

"Exception No. 3: Where the motor full-load current is less than 3.75 amperes in a polyphase motor circuit, the setting of an instantaneous trip circuit breaker shall not exceed 350 percent of the full-load current."

SUBSTANTIATION: Section 430-52 requires that the setting of an instantaneous trip circuit breaker shall in no case exceed 300 percent of motor full-load current. Hence the worst case condition permitted by Exception No. 2 at 3.74 amperes would be an instantaneous trip circuit breaker setting 350 percent of the full-load current. Where the full-load current is less than 3.75 amperes, the maximum permissible trip setting is proportionally less. Motor circuit breakers for motors having a full-load current of less than 3.75 amperes have amperage limitations not less than 15. (Table 310-16 specifies 15 as the minimum ampacity of #14 AWG wire and 21 as the ampacity of #18 AWG wire, the latter shown only for 90 degree Celsius insulation)

The current elements (heaters) for overload relays usually used to provide motor running overload protection in polyphase motor circuits have a resistance inversely proportional to the square of their current rating. Thus the lower the motor full-load current, the higher the resistance of the current element. The smallest standard rating of an instantaneous trip circuit breaker is 15 amperes. Inverse time circuit breakers rated 15 amperes trip instantaneously at approximately 105 amperes or more.

As the resistance of the current elements in the circuit breaker increases, the magnitude of any fault which can be produced on the load side of the fuse decreases to the point where if a short-circuit occurs in a 240 volt system supplying a motor with a full-load current of one ampere or less, the maximum fault current to activate the instantaneous trip mechanism of an inverse time circuit breaker, regardless of the short-circuit current available at the line terminals of the circuit breaker, for every supply voltage and any fault available at the circuit breaker line terminals, there is some overload relay current element appropriate for the motor full-load current where no instantaneous trip action by a 15 ampere inverse time circuit breaker possible, because of the relay's element's resistance. A fault current greater...
than 1,200 percent of motor full-load current that is not sufficient to trip an inverse time circuit breaker.

Instantaneous subjects the overload relay element to a current beyond its limit of self-protection and the element burns open before the inverse time portion of the circuit breaker can cause the breaker to trip. When the current element burns open it arcs and usually causes a new short-circuit within the controller enclosure. This second short-circuit is now not limited by the resistance of the current element and the circuit breaker now responds instantaneously, but only after the overload relay has been severely damaged.

Adjustable instantaneous trip circuit breakers rated less than 15 amperes are commercially available, some with trip settings as low as 7 amperes. By using instantaneous trip circuit breakers in lieu of inverse time circuit breakers in motor circuits where the full-load current is less than 3.75 amperes, instantaneous trip action by the circuit breaker can be obtained. The risk involved in having up to 25 feet of conductors between a separately mounted instantaneous trip circuit breaker and its associated motor controller protected against short circuit and ground faults at not more than 324 percent of their ampacity (worst case is 48.6/15 = 3.24) is less than the 333 percent permitted for transformer feeder taps by Exception No. 4 of Section 240-21.

The wording of proposed Exception No. 3 is such that it should encourage development and availability of polyphase inverse time circuit breakers that are rated less than 15 amperes and have time versus current-to-trip characteristics lower than those for inverse time circuit breakers rated 15 amperes. When such circuit breakers are available, they could be recognized as standard sizes in Section 240-4.

Note that this proposal would not restrict the use of 15 amperes inverse time circuit breakers in single phase motor circuits.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Present requirement is necessary. The Panel believes that extending the requirements as intended by this proposal is not appropriate at this time.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-52, Exception No. 2-(New): Reject

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 51 In Section 430-52 change "Exception to Exception No. 1" to Exception No. 2. The values given in Table 430-152 shall not apply to adjustable speed drive motors when the power conversion equipment provides only adjustable speed for the motor.

ADDITIONAL: A correction has been made to Exception No. 2 to have the values given in Table 430-152 shall not apply to adjustable speed drive motors when the power conversion equipment provides only adjustable speed for the motor.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel's action on Proposals Nos. 5 and 47, Sections 430-2 and 430-52.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-53(a): Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 52 Revise the text as follows: "Several motors each not exceeding one horsepower in rating shall be permitted on nominal 120 volt branch circuit protected at not over 20 amperes or a branch circuit of 600 volts, nominal, or less protected at not over 15 amperes, if all of the following conditions are met:"

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-53(a)(3): Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 53 Delete the word "running." (Proposal was shown to be valid by the UL Fact-Finding data and information provided to the Panel on performance of circuit breakers and fuses in that the same level of performance is provided as presently specified.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Uni

430-53(c)(3), Exception-(New): Reject

SUBMITTER: R.B. Boyd, Jr., Raleigh, NC

PROPOSAL: 58 Add exception as follows: "Each circuit breaker is of the inverse time type and, if rated more than 60 amperes, is approved for group installation."

SUBSTANTIATION: For many years we have treated single phase, window air-conditioning units as a single motor load and permitted branch circuit overcurrent protection to consist of either time limit or inverse time circuit breakers. As far as can be determined, field experience using such breakers rated at 50 amperes and less has been good. If this information is correct, then why not permit the smaller inverse time circuit breakers to be used in residential and small commercial branch circuits within the prescribed limits. Also many such fixed installations have been and are being accepted and field reports do not indicate difficulties resulting from the use of smaller inverse time circuit breakers.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Supporting comment is not persuasive to as necessity.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
430-53(d): Accept
SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL: 59 Delete the word "running" in line 8.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept as Revised.
NOTE: To propose in line 3 insert the words "short-circuit and ground-fault" after the words "branch-circuit."
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-65: Accept
SUBMITTER: A. P. White, Attleboro, MA
PROPOSAL: 60 Delete the word "running" in lines 2 and 4.
SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.
PANEL RECOMMENDATION: Accept.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-59-(New): Reject
PROPOSAL: 61 Add new 430-59 as follows:
430-59: Interrupting Rating. Every overcurrent protective device installed in a polyphase motor circuit where the voltage to ground exceeds 250 volts shall be marked with an interrupting rating.
SUBSTANTIATION: Section 240-83(c) requires that circuit breakers be marked with their interrupting rating only if it is other than 5,000 amperes. Section 240-80(c) requires that fuses be marked with their interrupting rating only if it is other than 10,000 amperes. At locations where polyphase power is supplied to motors at 480 and 600 volts there is high probability that the fault current available will exceed 5,000 amperes. Many will exceed 10,000 amperes.
By requiring an interrupting rating to be marked on the overcurrent protective device there is an automatic reminder to the installer to consider the fault current available at the point of installation. Our company is aware of two cases in the past year where a serious fault occurred in an industrial application and the overcurrent protective device did not do the fault successfully. In both cases personnel were injured. We should not look to the Code that will focus attention on the need to have overcurrent protective devices with interrupting ratings equal to or exceeding the fault current available.
PANEL RECOMMENDATION: Reject.
PANEL COMMENT: Panel feels subject is adequately covered.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-72: Accept
SUBMITTER: TSC-Control Circuit Protection
PROPOSAL: 64 Add (b) as follows:
(b) Conductor size. Motor control circuit conductors shall be sized in accordance with Section 310-5.
Exception: Where the motor control conductors are smaller than No. 14, the provisions of Article 725 shall apply.
SUBSTANTIATION: To correlate with companion proposal for new Exception No. 5 to Section 430-72(a). See that proposal for additional substantiation. Change will also correlate with proposed addition of Section 725-2(e).
PANEL RECOMMENDATION: Accept as Revised.
PANEL COMMENT: See action on Proposals Nos. 63 and 65.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

EXPLANATION OF VOTE:
SUBMITTER: A. P. White, Attleboro, MA
GUBANY: I am voting negative on Panel rejection since it can be proven that No. 16 and No. 18 wire cannot be protected by a 20 amperes overcurrent protective device against some high impedance faults within the overcurrent devices rating or when high short-circuit currents are available. As written, this proposal violates 110-30 and 240-1 of the NEC. Also, circuit transformers cannot be protected by secondary control circuit protection. A control transformer should have the same protection as any other device where an overcurrent in any other enclosure. Control transformers should be protected as required in Article 450. Control transformers are a big source of fire since the primary protection is usually much too great to provide any protection.

EXPLANATION OF VOTE:
SUBMITTER: A. C. Clark, Manufacturing Chemists Assn.
GUBANY: I am voting negative on Panel acceptance since it can be proven that No. 16 and No. 18 wire cannot be protected by a 20 amperes overcurrent protective device against some high impedance faults within the overcurrent devices rating or when high short-circuit currents are available. As written, this proposal violates 110-30 and 240-1 of the NEC. Also, circuit transformers cannot be protected by secondary control circuit protection. A control transformer should have the same protection as any other device where an overcurrent in any other enclosure. Control transformers should be protected as required in Article 450. Control transformers are a big source of fire since the primary protection is usually much too great to provide any protection.

EXPLANATION OF VOTE:
SUBMITTER: Robert J. Cunningham, Duquesne Light Company
GUBANY: I am voting negative on Panel rejection since I agree with the author's supporting comment. This proposal will enhance compliance with 110-9 and 110-10.
Exception No. 2: Where the transformer supplies a Class I power-limited, Class 2 or Class 3 remote control circuit conformity with the requirements of Article 725.

Exception No. 3: Where protection is provided by other approved means.

Exception No. 4: Overcurrent protection shall be omitted where the opening of the control circuit would create a hazard, as for example, the control circuit of a fire pump motor, and the like.

SUBSTANTIATION: For coordination of control circuit requirements. The intent is to apply Section 430-72 to all portions of a control circuit tapped from a motor branch circuit, and to apply Article 725 in all other cases, as specified in Section 430-72(a). Other than editorial changes, the following relates proposed revised Section 430-72 to the 1978 NEC and other TSC proposals. 430-72(a) To coordinate with Article 725, as stated above. See also TSC Proposal No. 5 for new Section 725-2(e).

430-72(b) Exception No. 2 - Equivalent to Section 430-72(a), Exception No. 1 in 1978 NEC. Same as Table 400-5, and reflect recognized practice. Reference to Table 310-17 reflects recognized practice.

430-72(b), Exception No. 2 - Equivalent to Section 430-72(b), Exception No. 1 in 1978 NEC. Same as Section 240-3, Exception No. 5 with word “only” preceding “a 2-wire (single-voltage) secondary.” For clarification of intent. See also TSC Proposal No. 7 for new Section 725-12(b) and (c), Exception No. 2.

430-72(b), Exception No. 4 - Equivalent to Section 430-72(a), Exception No. 4 of 1978 NEC. Same as Section 240-13, Exception No. 5, and Table 400-5, and reflect recognized practice. Reference to Table 310-17 reflects recognized practice.

430-72(c) - To coordinate with Article 725. See TSC Proposal No. 9 for new Section 725-12(c).

430-72(c), Exception No. 1 - Similar to Section 430-72(b) in 1978 NEC but restricted to (1) control circuits tapped from motor branch-circuit and (2) transformers integral with motor controller where transformer primary is within controller, not field-wired.

430-72(c), Exception No. 2 - Equivalent to Section 430-72(b), Exception No. 2 in 1978 NEC. Coordinates with Article 725.

430-72(c), Exception No. 3 - Same as Section 430-72(b), Exception No. 3 in 1978 NEC.

430-72(c), Exception No. 4 - Equivalent to Section 430-72(b), Exception No. 4 in 1978 NEC.

PANEL RECOMMENDATION: Accept as revised:

In Section 430-72(b)(1) of the Proposal, second sentence, after “ampacities” delete the words “for control circuit conductors No. 14 and larger.”

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 16.
NEGATIVE: Gubany, Kish.

EXPLANATION OF VOTE:

GUBANY: I am voting against the Panel’s acceptance for the same reasons as for Proposal No. 63.

430-72(a): Reject

SUBMITTER: Joseph L. Yosafat, General Electric Co.

PROPOSAL: 66 In the second paragraph, before the last three words “shall not apply” add the words “regarding ampacities.”

SUBSTANTIATION: The purpose of this proposal is to clarify the requirement that only the ampacities stated in Article 310 are applicable to control circuits within an enclosure. It is possible to interpret the present wording to mean that all requirements of Article 310, such as minimum size of conductors are applicable.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: See action on Proposals Nos. 63 and 65.

430-86(a): Reject

SUBMITTER: Robert S. MacManus, Pawtucket, RI

PROPOSAL: 77 Delete Section 430-86(a).

SUBSTANTIATION: Section 430-86(a) allows the motor and driven machinery to be out of sight from the controller location if the controller disconnecting means is capable of being locked in the open position. A similar condition existed with Section 430-102 previous to the 1965 NEC, but the words “or be arranged to be locked in the open position” were omitted from the 1965 NEC apparently because of a hazard to a man working on the controller. Since the same hazard exists when the motor and driven machinery are out of sight from the controller location, there seems to be an apparent contradiction between Section 430-86 and Section 430-102.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: See action on Proposals Nos. 63 and 65.

AFFIRMATIVE: 16.
NEGATIVE: Gubany, Kish.

EXPLANATION OF VOTE:

KISH: A transformer should be protected according to Section 450-3 and we should not take an exception without justification.

Woods: Wood is voting negative on Proposal 66 since I support the author’s reasoning that control transformers should be protected as per Article 450. The transformer does not know where it is located. It should be protected on the primary as required in Article 450.

PROPOSAL: 78 Where the motor control circuit conductors are based on 400 percent of ampacities of 7 and 10 amperes, are protected to the same degree as is permitted by Exception No. 1 under 430-72(a).

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 16.
NEGATIVE: Gubany, Kish.

EXPLANATION OF VOTE:

GUBANY: I am voting negative on Proposal 78 since I agree with the author’s reasoning that control transformers should be protected as per Article 450. The transformer does not know where it is located. It should be protected on the primary as required in Article 450.

Control transformers are a big source of equipment fire. Sooner or later the transformer will break down and should not result in a fire.

It can be easily demonstrated that a shorted primary or secondary will cause ignition.

KISH: A transformer should be protected according to Section 450-3 and we should not take an exception without justification.

PROPOSAL: 79 Where the motor control circuit conductors are tapped from conductors No. 14 and larger, the values of 25 amperes for No. 18 and 40 amperes for No. 16 conductors are based on 400 percent of ampacities of 7 and 10 amperes respectively, as specified in Table 400-6, and reflect recognized practice. Reference to Table 310-17 reflects recognized practice.

430-72(b), Exception No. 2 - Equivalent to Section 430-72(a), Exception No. 1 in 1978 NEC. Same as Table 400-5, and reflect recognized practice. Reference to Table 310-17 reflects recognized practice.

430-72(b), Exception No. 2 - Equivalent to Section 430-72(b), Exception No. 1 in 1978 NEC. Same as Section 240-3, Exception No. 5 with word “only” preceding “a 2-wire (single-voltage) secondary.” For clarification of intent. See also TSC Proposal No. 7 for new Section 725-12(b) and (c), Exception No. 2.

430-72(b), Exception No. 4 - Equivalent to Section 430-72(a), Exception No. 4 of 1978 NEC. Same as Section 240-13, Exception No. 5, and Table 400-5, and reflect recognized practice. Reference to Table 310-17 reflects recognized practice.

430-72(c) - To coordinate with Article 725. See TSC Proposal No. 9 for new Section 725-12(c).

430-72(c), Exception No. 1 - Similar to Section 430-72(b) in 1978 NEC but restricted to (1) control circuits tapped from motor branch-circuit and (2) transformers integral with motor controller where transformer primary is within controller, not field-wired.

430-72(c), Exception No. 2 - Equivalent to Section 430-72(b), Exception No. 2 in 1978 NEC. Coordinates with Article 725.

430-72(c), Exception No. 3 - Same as Section 430-72(b), Exception No. 3 in 1978 NEC.

430-72(c), Exception No. 4 - Equivalent to Section 430-72(b), Exception No. 4 in 1978 NEC.

PANEL RECOMMENDATION: Accept as revised:

In Section 430-72(b)(1) of the Proposal, second sentence, after “ampacities” delete the words “for control circuit conductors No. 14 and larger.”

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 16.
NEGATIVE: Gubany, Kish.

EXPLANATION OF VOTE:

GUBANY: I am voting against the Panel’s acceptance for the same reasons as for Proposal No. 63.

430-72(b): Reject

SUBMITTER: Paul Hoh, Bussmann Mfg.

PROPOSAL: 69 Revise as follows:

(5) When a motor control circuit transformer is provided it shall be protected according to Section 450-3.

SUBSTANTIATION: Control transformers are a potential fire hazard whether they are a motor control transformer or a control transformer for other type(s) of equipment. Control transformers should be protected in compliance with 450-3. The same level of protection should be afforded control transformers for motor control.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: To support the comment is not persuasive as to necessity.

PANEL COMMENT: See action on Proposals Nos. 63 and 65.

AFFIRMATIVE: 15.
NEGATIVE: Gubany, Kish.

EXPLANATION OF VOTE:

GUBANY: I am voting negative on Proposal 69 since I support the author’s reasoning that control transformers should be protected as per Article 450. The transformer does not know where it is located. It should be protected on the primary as required in Article 450.

Control transformers are a big source of equipment fire. Sooner or later the transformer will break down and should not result in a fire.

It can be easily demonstrated that a shorted primary or secondary will cause ignition.

KISH: A transformer should be protected according to Section 450-3 and we should not take an exception without justification.
430-87, Exception: Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 71 Change "For motors of 600 volts or less..." to "For motors of 600 volts or less..."

STATION: To conform to the guidelines established by the TSC on Nominal Voltages.

VOTE ON PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-101 FPN-(New): Reject

SUBMITTER: I. I. Anderson, IAEE

PROPOSAL: 72 Add a third fine print note following Section 430-101

SECTION 110-23 for disconnecting means for controllers used to control loads other than motor loads.

STATION: To cross reference that a disconnecting means shall be required to be "in sight of" the controller.

VOTE ON PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-102, Exception No. 1: Reject

SUBMITTER: John J. Lee, General Electric Co.

PROPOSAL: 73 Revise as follows:

"For motors of 600 volts or less..."

STATION: To conform to the guidelines established by the TSC on Nominal Voltages.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-100(c)(1), Exception No. 5: Accept

SUBMITTER: R. H. Lee, Lee Electrical Eng., Inc.

PROPOSAL: 74 Revise as follows:

"For motors of portable appliances rated at 2 horsepower or less and 300 volts or less, an attachment plug and receptacle shall not be required for a motor rated 2 horsepower or less."

STATION: To conform to the guidelines established by the TSC on Nominal Voltages.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-110(c)(1), Exception: Accept

SUBMITTER: J. J. Kark, National Electrical Manufacturers

PROPOSAL: 75 Change the reference to "Table 430-151" in third paragraph to read "Table 440-XX." 

SUBMISSION: See Note 2 on Table 430-151.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
heaters around the extruder barrel. Established Industry practice has been to use only remote disconnect switches adjacent to the motor housing. The disconnect switch is generally of the non-lockable type. A motor itself often contains RTD's, thermistors, or switches within the motor housing. Established Industry practice has been to use only remote disconnect switches and these sensors.

Industrial establishments have followed the above established practices for years and have achieved an excellent safety record where the equipment is serviced by qualified personnel. For such reasons, Section 430-113 is over restrictive and should be changed by the proposed Exception 2.

**Panel Recommendation:** Reject.

**Panel Comment:** Panel request is necessary.

**Vote on Panel Recommendation:**
- **Affirmative:** 16.
- **Negative:** 0.

**Explanation of Vote:**
- **Affirmative:** I contend that operator safety is jeopardized as the disconnecting means in the motor or motor-operated equipment for each source of energy. In the first place the number of switches required would block the operator's view or allows for an in multi-motor (up to 100 or more motors per line) processes such as steel, auto, chemical, and paper.

In the second place, the danger to an operator of pulling a DC field switch on a DC motor or a synchronous motor is great. It would also be dangerous to the operator if he pulled the disconnect switch on safety devices such as pressure, flow, zero speed, or photocell switches.

The hostile operating floor environment (oil, dirt, corrosive chemical, and hazardous atmospheres) where these switches would be located in will lead to early failure. This is a hazard to operators from electrical energy release and from malfunctions of safety devices.

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**430-113, Exception No. 2 (New):** Accept

**Submitter:** Alton R. Thompson, Durham, NC

**Proposal:** 78

**Exception No. 2:** A separate disconnecting means shall not be required for a Class II or Class III remote-control circuit of 50 volts or less.

**Substantiation:** This would resolve a lot of problems in the field where now a disconnect is required. Class 2 and Class 3 circuits of 50 volts or less would not create a shock hazard, a fire hazard, or a mechanical hazard needed to clear up confusion by specifically permitting what is generally being excepted.

**Panel Recommendation:** Accept as Revised.

*Change: Class II and Class III to 'Class 2' and after "circuit" change the rest of the sentence to read "conforming with Article 430-125(a) and no more than 50 volts and which is isolated and grounded."

*Change existing exception to Exception No. 1 and add the proposed exception as above.

**Voting on Panel Recommendation:** Unanimously Affirmative.

**Comment on Vote:**

**Support:** My reason for voting affirmatively on the proposal is that it provides some relief relative to alleviating the necessity to supply immediately adjacent disconnects for some Class 2 circuits used in industrial and monitoring systems.

However, in my voting affirmatively to reject Proposal No. 77, I feel this proposal should be expanded to include the following additional exceptions:

**Exception No. 3:** External interlock control circuits and monitoring circuits operating at less than 150 volts need not be interconnected, because a remote disconnect is identified and covered and a warning label is attached adjacent to the equipment enclosure disconnect.[s] identifying the source and location of the interlock contacts and monitoring circuits.

**Exception No. 4:** Separately excited synchronous and direct current motors need not have their field circuits interconnected, provided that a warning label is attached adjacent to the field terminal box identifying the location of the remote source disconnecting means capable of being locked in the open position.

My substantiating comments for proposing to add Exceptions No. 3 and No. 4 are:

Section 430-113, as written, is so broad and far reaching as to be impractical. For example, the term "energy," unless defined as to magnitude and potential, would include any device such as thermo-couple outputs or potential is in millivolts creating no hazard. Also included would be telemetry circuits, proximity switch outputs, sensors, switch outputs, dry safety control interlock contacts, etc. In an integrated process or high-automated assembly or manufacturing operation, a central control system could have many sources of energy. It would be highly impractical and essentially not feasible to provide disconnects on all these sources. Greater hazards would be created in the event that a safety interlock were left open after servicing the equipment. The switch could fail or become inoperative due to a loose wire or contamination resulting in the opening of a critical interlock circuit which may result in extensive damage to a process or create an explosion hazard. In hazardous areas, explosion-proof switches would be added, increasing the hazard potential in these areas. As more combinations and switches are added, reliability decreases.

A second example of motor-operated equipment is a motor driven conveyor with photocell sensors along the conveyor. For these circuits of 50 volts or less would not create a shock hazard, a fire hazard, or a mechanical hazard needed to clear up confusion by specifically permitting what is generally being excepted.

**Panel Recommendation:** Accept.

**Panel Comment:** Proposal is primarily a design consideration.

**Vote on Panel Recommendation:**
- **Affirmative:** 16.
- **Negative:** 0.

**Explanation of Vote:**
- **Affirmative:** I am voting negative on Panel's rejection since I agree with the author's substantiating comment. I am very timely that equipment is currently marked for overcurrent protection in order for the installation to comply with Section 110-10 and Section 240-2. The proper matching of overcurrent protective devices with the wiring listings of equipment and components should be made very obvious.

**Substantiation:** See A. P. White substantiation for proposal for Diagram 430-1.

**Proposal:** 80

**Delete the words "running overcurrent (overload)" and replace with the word "overload."**

**Substantiation:** See A. P. White substantiation for proposal for Diagram 430-1.

**Panel Recommendation:** Accept as Revised.

*Restrict proposal to Exception No. 3 delete the words "motor-running overcurrent (overload)" and replace with the word "overload."*

**Vote on Panel Recommendation:** Unanimously Affirmative.

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**430-125(a):** Accept

**Submitter:** A. P. White, Attleboro, MA

**Proposal:** 80

**Delete the words "running overcurrent (overload)" and replace with the word "overload."**

**Substantiation:** See A. P. White substantiation for proposal for Diagram 430-1.

**Panel Recommendation:** Accept as Revised.

**Vote on Panel Recommendation:** Unanimously Affirmative.

**430-132(d), (e), and (f)-Reject:**

**Submitter:** R. S. Pinkerton, Los Angeles, CA

**Proposal:**

**Add new note as follows:**

[D]: Motor control equipment which is accessible to unqualified persons shall be enclosed and shall be arranged to be operable, including the resetting of overcurrent protective devices, from the outside of the enclosing case.

Exception No. 1: The resetting means need not be externally operable provided the interlocking means is part of the controller and is interlocked that the controller door cannot be opened when any bare parts are energized in the controller enclosure.

Exception No. 2: Elevator control equipment located as
providing in Article 620 need not be enclosed.

(e) Where mechanical equipment such as valves, gages, regulators or similar equipment which requires manual adjustment are installed within the same enclosure with live parts, barriers shall be provided to separate live parts from mechanical equipment.

(f) Where two or more contactors or other controllers are installed in the same cabinet or other enclosure, suitable barriers shall be installed between them.

Exception: Where all the devices in the enclosures serve a single machine and are simultaneously de-energized by a single disconnecting means, barriers will not be required.

SUBSTANTIATION: In the normal process of operating many types of machines, particularly those of the overload device or replacing fuses. Rarely is time taken to call an electrician for this simple operation and the machine operator resets the equipment. As people are operating this equipment who are unqualified in terms of electrical hazards, it is necessary to specify and provide control equipment which is totally enclosed and the necessary resetting can be accomplished without exposing the operator to live parts.

Furthermore, controller enclosures frequently contain mechanical equipment which requires adjustment or contains several controllers for independently operating machines. Mechanics for the machines should not be exposed to live energized parts when they turn a valve or set regulator or manually adjust mechanical equipment. Maintenance electricians should not be required to replace motor controllers or replace parts where there are adjacent non-barriered and energized motor controllers.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Proposal is primarily a design consideration.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

430-132(d), (e), and (f)-(New): Reject

SUBMITTER: Southwestern Section IAEI

PROPOSAL: 82 Add a fine print note following Section 430-132(a):

See Section 430-12(e) for grounding connection devices or fittings required at motor terminal housings. (See proposal 430-12(e).)

PANEL RECOMMENDATION: Accept as Revised:

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Table 430-149:

| Submittal | Proposal 430-149 | Accept
|-----------|-----------------|-------
| SUBMITTER | J. J. Kark, National Electrical Manufacturers
| PROPOSAL | 44 Remove the four columns and the heading for "Synchronous Type Unity Power Factor Amperes". Remove the + reference at the bottom of the Table.
| SUBSTANTIATION | This synchronous motor portion of the two-phase Table 430-149 should either be revised to show volatges of 230, 460 and 575 with currents for these voltages or the columns should be eliminated.
| VOTE ON PANEL RECOMMENDATION | Unanimously Affirmative.

Table 430-151:

| Submittal | Proposal 430-151 | Accept
|-----------|-----------------|-------
| SUBMITTER | J. J. Kark, National Electrical Manufacturers
| PROPOSAL | 85 Remove this Table from Article 430 and add the CORRECTIVE in this Table as Table 440-XX in Article 440.
| SUBSTANTIATION | Some confusion has developed because the present NEMA Table for locked-rotor current differs somes from the values in Table 430-151. As part of Article 430, the Table 430-151 has been considered as a specification for general purpose motors, whereas the Table is intended for use in conversion between current and hp ratings of circuit components. Changes in the values in Table 430-151 are not practical because of numerous approvals of apparatus based on these currents which are known to provide satisfactory applications. Correlating changes are required in Sections 430-110 and 440-4.
| VOTE ON PANEL RECOMMENDATION | Unanimously Affirmative.

Table 430-152:

| Submittal | Proposal 430-152 | Accept
|-----------|-----------------|-------
| SUBMITTER | Southwestern Section IAEI
| PROPOSAL | 83 Add a fine print note following Section 430-152(a):

See Section 430-12(e) for grounding connection devices or fittings required at motor terminal housings. (See proposal 430-12(e).)

PANEL RECOMMENDATION: Accept as Revised:

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 440 -- AIR-CONDITIONING AND REFRIGERATING EQUIPMENT

440-3(b): Reject

SUBMITTER: Richard J. Denny, Air Conditioning & Refrigeration Institute

PROPOSAL: 87 Add a sentence before the last sentence as follows:

In no case shall the marked maximum rating of the branch-circuit short-circuit and ground-fault protective device be less than the marked minimum supply circuit conductor ampacity.

SUBSTANTIATION: The actual marked values may be greater than the calculated minimum, and/or may be less than the calculated maximum. Under the present rules, the marked maximum rating of the branch-circuit short-circuit and ground-fault protective device (fuse or circuit breaker) could be less than the marked minimum supply circuit conductor ampacity, especially since the marked maximum fuse or circuit breaker rating is normally reduced from the calculated maximum to a standard rating as given in Section 240-6. The possibility of this occurrence is greatest when a substantial part of the combination load is electric resistance space heating. There are heat pumps on the market with this cross-over of marked limits. Although Section 440-22(b) permits the rating of the fuse or circuit breaker to be increased to the next standard rating higher than the conductor ampacity (by reference to Section 430-53, which refers to Section 430-3 Exception No. 1), the marked maximum rating of the fuse or circuit breaker cannot be exceeded. The change is to remove unintended permission for a crossover of the minimum and maximum marked values.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel comment on Proposal No. 88.

EXPLANATION OF VOTE:

SCHRAM: While we agree a design consideration is involved, it is the design of the marking. We do not believe the Code should permit a marking which is in conflict with the intent, as stated in the proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

440-12(b)(1), Exception: Accept

SUBMITTER: Richard J. Denny, Air Conditioning & Refrigeration Institute

PROPOSAL: 91 Revise as follows:

Exception: When part of the concurrent load is a resistance load and the disconnecting means is a switch rated in horsepower and amperes, the horsepower rating of the switch is permitted to be less than the combined load to the motor-compressor(s) and other motor(s) at the locked-rotor condition, provided the ampere rating is not less than this locked-rotor load plus the resistance load.

SUBSTANTIATION: Change is for permissive wording. Section 440-12(b)(1) provides for adequate rating of disconnect without application of exception. When motor load is small with respect to resistance heater load, exception may permit lower adequate rating of disconnect; however, when motor load is larger with respect to resistance heater load, application of exception could result in higher rating of disconnect than necessary.

PANEL RECOMMENDATION: Accept as Revised:

Exception: Where part of the concurrent load is a resistance load and the disconnecting means is a switch rated in horsepower and amperes, the horsepower rating of the switch shall be permitted to be less than the combined load to the motor-compressor(s) and other motor(s) at the locked-rotor condition, if the ampere rating of the switch is not less than this locked-rotor load plus the resistance load.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

440-21: Accept

SUBMITTER: A. P. White, Attleboro, MA

PROPOSAL: 93 Delete the word “overcurrent” in line one.

SUBSTANTIATION: See A. P. White substantiation for proposal for Diagram 430-1.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

440-22(b) Exception No. 3-(New)(MHD 1978 NEC): Accept

SUBMITTER: J. J. Kark, National Electrical Manufacturers Association

PROPOSAL: 90 Change the references to "Table 430-151" to read "Table 440-IX."

SUBSTANTIATION: See NEMA Proposal - on Table 430-151.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel comment on Proposal No. 85A.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
Successful results with specific equipment approved as individual types or models for circuit breaker branch circuit protection have shown that such devices do not constitute a safety hazard. Consequently, they have been approved as of this date. The Committee has, however, permitted improved protection to power utilization equipment by disconnecting all ungrounded supply conductors simultaneously.

Panel recommendation: Unanimously Affirmative.

Copies: 60 amps to 50 amps.

Vote on panel recommendation: Unanimously Affirmative.

Negative: Amanian, Gubany, Kish, Lawry, Myers, O'Brien, Osborn, Smith.

Not Voting: Aquilino, Lopez.

Comment on vote: O'Brien.

The data submitted indicates that the test data submitted to the Panel without the reduction to 50 amperes.

Wood: I find the affirmative on this proposal since it is generally known that a large percentage of these installations have been installed with circuit breaker protection. There appears to be very little evidence of this type of installation causing or contributing to loss of life or fire. Through the various test data supplied to the Panel it has become apparent to me that no overload devices, fuses or circuit breakers, provide adequate protection on multi-motor circuits. This Panel should be concerned regarding protection on all types of multi-motor circuits as it appears that damage to circuit components is prevalent when any single overload device is used.

Explanation of vote: Amanian.

In reviewing the Fact-Finding Report conducted by UL for the Air Conditioning and Refrigeration Institute it was noted that the tests conducted by fuse and circuit breaker manufacturers appear that inadvertent use of either 60 ampere fuses or circuit breakers in equipment component and/or wire damage and burning. One would have to conclude that the equipment branch-circuit/short-circuit and ground fault protective devices used in these tests, whether fuse or circuit breaker, cannot assure the protection of No. 18 or No. 16 tap conductor wires nor certain components. Small wire sizes, overload heaters and contactors are not designed to withstand and thermal ratings approved for the installation by a recognized testing laboratory.

Aquilino: Considerable test data has been presented both for and against this proposal. In view of the conflicting data and lacking the facilities to confirm the test results myself, I do not feel there is sufficient justification for either an affirmative or negative vote at this time.

Gubany: I am voting against acceptance of Proposal No. 94 for the following reasons:

1. This is the second type of proposal which was declared nonconsensus for the 1978 Code.
2. No new substantiating data was submitted at the last CMP 11 meeting to support the ARI/UL Fact-Finding Report which recorded destroyed and damaged air-conditioning and electric furnace components. Section 110-10 requires component protection and 240-2 requires protection of equipment, not destruction.
3. Using 50A, 60A and even 100A overcurrent devices to protect No. 18 tap conductor wire with the sectional external and internal sections of the NEC as well as the intent of the NEC which limits the protection to 20A as in 240-4, such as in fixtures and approved cords for appliances, which generally do not exceed six (6) feet. Even in 725-12, where the consumers leave the enclosure, the overcurrent protection is limited to 20A.
4. The change from 60A to 50A branch circuit doesn't change the damage and destruction recorded in the 1970 ARI/UL Fact-Finding Report of 1978 and no new Fact-Finding Report was submitted on component protection. An air-conditioner or any other equipment can have any size branch circuit.
5. The owner's or users' equipment or property should not be permitted to be subjected to the damage and destruction reported in the 1970 ARI/UL Fact-Finding Report using circuit breakers.

Note 1: Section 240-2 refers to Protection of Equipment, not destruction. Also, note 240-1, the word "protection" is prominent.

Note 2: This Proposal is for all practical purposes the same as Proposal No. 57 which the Panel voted to reject.

Kish: Approval for fuse or circuit breaker type circuit breakers should not get a blanket approval. While tests were run on specific fuses and circuit breakers to show their worthiness, approval would come only from recognized testing laboratories for each group.

Larty: It has been suggested that test data submitted to CMP 11 indicates that ground fault protective devices are as safe as fuses for group motor installations and consequently, as for fuses, should be recognized for group installations without specific approval for that purpose. In my opinion, this data indicates that both fuses and circuit breakers should be approved for group installation, or possibly group installations should even be prohibited.

Lopez: I am abstaining from voting on this proposal and deferring this to the judgment of other Panel members who have the specialized knowledge and experience relative to the application and protection of the equipment covered by this proposal.

Myers: Circuit breaker test data submitted at the Panel meeting was impressive but it was a test of only one manufacturer's circuit breaker. If the proposal is approved it would give blanket approval to all circuit breakers. I feel this is a problem that must be resolved between the manufacturers and a recognized testing agency, not the Code-Making Panel.

O'Brien: Our position is to reject Proposal No. 94 due to insufficient evidence to support the suggested changes. It is our position that the consumer is better protected with the present language in the Code.

Osborn: Data submitted puts serious doubts on the advisability of multi-motor branch circuit with any type of overcurrent protection. CMP 11 now should restrict multi-motor branch circuit protection.

Smith: The present wording of the proposal automatically qualifies inverse-time type circuit breakers for the purpose. The NEC should not be the judge of a product's ability to perform adequately or safely. The agency to perform the tests should be a recognized testing laboratory.

If the capability of the circuit breaker to protect is demonstrated and documented then this proposal is acceptable.
allow for individual branch circuits and matching plug receptacles up to 50 amperes.

Further, Section 210-23 states "It shall be acceptable for an individual branch circuit to supply any load for which it is rated."

The overload protection need only protect the equipment per 440-52(a). The protection of the branch circuit and control apparatus required under 440-82(b) is not needed since it is provided by the branch circuit protection.

**Panel Recommendation:** Reject.

**Panel Comment:** Panel feels subject is adequately covered.

**Vote on Panel Recommendation:** Unanimously Affirmative.

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440-56-(New): Reject CMP 11

**Submitter:** R. L. Eichhorn, Whirlpool Corp.

**Proposal:** 98 Add new sentence as follows:

440-56. Cord-and Attachment Plug-Connected Motor-Compressors and Equipment on 20-, 30-, 40-, 50-Ampere Branch Circuits. Overload protection for motors, compressors and equipment that are cord-and attachment plug-connected, approved for the purpose, and used on 20-, 30-, 40-, or 50-ampere 208- or 240-volt, single-phase branch circuits as permitted in Article 210 shall be permitted by indicated in (a), (b), and (c) below.

(a) The motor compressor shall be provided with overload protection as specified in Section 440-52(a). Both the controller and motor overload protective device shall be approved for installation with the short-circuit and ground-fault protective device for the branch circuit to which the equipment is connected.

(b) The rating of the attachment plug and receptacle shall not exceed 50 amperes at 250 volts.

(c) The short-circuit and ground-fault protective device protecting the branch circuit shall have sufficient time delay to permit the motor-compressor and other motors to start and accelerate their loads.

**Substantiation:** Cord-and attachment-plug connected equipment to permit the motor-compressor and other motors to start and accelerate their loads.

**Panel Recommendation:** Reject.

**Panel Comment:** Panel feels subject is adequately covered.

**Vote on Panel Recommendation:** Unanimously Affirmative.

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Table 440-XX-(New): Reject CMP 11

**Submitter:** J. J. Kark, National Electrical Manufacturers Association

**Proposal:** 99 Use the complete contents of Table 430-151 from the 1978 Code with the following title:

**Table 440-XX. Conversion Table of Locked-Rotor Currents for Selection of Disconnecting Means and Controllers**

As determined from horsepower and voltage rating. For use only with Sections 430-110, 440-12 and 440-41.

**Panel Recommendation:** Reject.

**Panel Comment:** See Proposal No. 85A.

**Vote on Panel Recommendation:** Unanimously Affirmative.

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**CHAPTER 9 -- TABLES AND EXAMPLES**

**Chapter 9, Example No. 8:** Accept

**Secretary's Note:** It was the action of the Correlating Committee that the responsibility for the Examples has been assigned to the Chairman of the Panel and the Secretary of the Correlating Committee.

**Submitter:** A. P. White, Attleboro, MA

**Proposal:** 100 Change in title word: "Overcurrent" to "Overload and Short-Circuit and Ground-Fault."

Change in line 1 first paragraph words: "running overcurrent" to "overload."

Insert in line 2 first paragraph words: "short-circuit and ground-fault ahead of "protection."

Change heading "Overcurrent Protection" to "Overload and Short-Circuit and Ground-Fault Protection."

**Substantiation:** See A. P. White substantiation for proposal for Diagram 430-1.

**Panel Recommendation:** Accept as Revised.

In Chapter 9, Example 8 change the following to read:

Change the heading "Overcurrent Protection" to "Overload and Short-Circuit and Ground-Fault Protection."

Change subheading "Running" to "Overload."

Add to paragraph 1, before "the 25-h.p. motor," "Where protected by a separate overload device."

In the first sentence after "42.5 amperes.," "(Section 430-32(a)(1))."

In the second sentence before "the 30-h.p. motor," "Where protected by a separate overload device."

"(Section 430-32(a)(1))."

At the end of paragraph 1, add a new sentence to read: For a motor marked "thermally protected" overload protection is provided by the thermal protector (see Sections 430-7(a)(12) and 430-32(a)(2)). Change second subheading "Branch Circuit" to read "Branch Circuit, Short-Circuit and Ground-Fault."

In subheading "Feeder Circuit" add the end of paragraph "(Section 430-65(a))."

**Vote on Panel Recommendation:** Unanimously Affirmative.

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ARTICLE 445 -- GENERATORS

445-1: Reject
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: Amend Section 445-1 to include Article 240.
SUBSTANTIATION: 240-21 tells us all conductors shall be protected at point of supply. The inherent design of a generator only protects the generator itself. Nowhere in Article 445 does it give any specific overcurrent protection for the conductor leading from the generator.

These generators can be changed in the field to a larger generator without any knowledge of conductor ampacity or overcurrent requirements thereby causing an overload on the conductors and creating a fire hazard.

In some installations, the conductors leading from the generator to the first overcurrent device is greater than 100 feet.

See Proposal No. 3 for 445-5.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Unduly restricting design for larger units where other methods to prevent overloading of conductors have shown to be adequate. Overcurrent protection should be as close as practicable, but 25 feet is too restrictive.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

445-5: Accept
SUBMITTER: George W. Flach, New Orleans, LA
PROPOSAL: Add a sentence to the end of 445-5 as follows:

"This rule shall be permitted to size the neutral conductors in accordance with Section 220-22." (See 240-21)

SUBSTANTIATION: To clarify requirements for sizing the neutral.

PANEL RECOMMENDATION: Accept as revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

445-5: Reject
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: Amend 445-5 by adding another sentence stating:

"The conductor shall not be over 25 feet in length and shall terminate with a single circuit breaker or a single set of fuses that will limit the load to the ampacity of the conductors."

SUBSTANTIATION: 250-5(d) states that generators are a separately derived system. If they are such we should have some rules for giving the conductors from the generator proper protection. There are times when it is hard to install an overcurrent device at the generator location. If we used a 25 foot tap rule from the generator to the overcurrent device it would prevent installations of great distance from the generator to the overcurrent device. 240-21 tells us all conductors shall be protected at point of supply. The inherent design of a generator only protects the generator itself. Nowhere in Article 445 does it give any specific overcurrent protection for the conductor leading from the generator.

See Proposal No. 1 for 445-1.

PANEL RECOMMENDATION: Reject.

COMMENT ON VOTE:

"FLACH: Separating this proposal as has been done in Proposal Nos. 21A through 21S should reduce this confusion between requirements for emergency, legally required stand-by, and optional stand-by systems."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

445-6: Accept
SUBMITTER: TSC-Nominal Voltage
PROPOSAL: Change "generators operated at more than 150 volts to ground" to "generators operated at more than 150 volts to neutral." (See 240-21).

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 480 -- STORAGE BATTERIES

Article 700: Reject
SUBMITTER: H. K. Glenn, Pacific Coast Electrical Assn.
PROPOSAL: 6 Combine Articles 700 and 750.

SUBSTANTIATION: Adopt the report of CMP TSC to combine Articles 700 and 750. Complete text as shown on pages 391, 392, 393, 394 of the "Preprint of the proposed amendments for the 1978 National Electrical Code." NFPA No. 70 PR 78.

The present separation of the articles, both of which deal with alternate power sources and distribution systems intended to be functional when normal power supplies are disrupted, is illogical and is a source of conflict in application and enforcement.

The TSC report was well conceived and the integrated subject matter provides a much more coherent coverage of alternate Power Systems. The supporting comment by CMP 22 which accompanied the proposal thoroughly covers the subject and is still pertinent. The Correlating Committee (see Secretary's note) apparently agreed with the developed material, but unfortunately the assignment to "process new material in the appropriate articles" was not accomplished. Such action to pull apart the work of the TSC would be ill-advised and would destroy the logical arrangement.

PANEL RECOMMENDATION: Reject.

COMMENT ON VOTE:

"The Correlating Committee has instructed CMP 22 to keep the articles separate.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 700 -- EMERGENCY SYSTEMS

PANEL COMMENT: See CMP action on Proposal No. 7. The Correlating Committee has instructed CMP 22 to keep the articles separate.

COMMENT ON VOTE:

"FLACH: Separating this proposal as has been done in Proposal Nos. 21A through 21S should reduce this confusion between requirements for emergency, legally required stand-by, and optional stand-by systems."
ARTICLE 450 -- TRANSFORMERS AND TRANSFORMER VAULTS

450-1, Exception No. 9 (New): Reject

SUBMITTER: J. D. Riley, Industrial Gas Cleaning Institute

PROPOSAL: 1 Exception No. 9: Transformer used as controlled power supplies for electrostatic precipitators.

SYNOPSIS: To exempt electrostatic precipitator power supplies from any requirements for protection from explosion, fire and/or tank rupture such as: Vaults, pressure relief vents, space separation, barriers, water spray systems, enclosures, dikes, basin or trapped drains.

Such requirements are being enforced by some interpreters of NEC Articles 450-23, 450-24, 450-25 and 450-26.

Industrial Electrostatic Precipitator Power Supplies are not used as transformers in the normal sense, but rather as sources of high voltage (35,000-75,000 volts) and low current (less than 3 amps) power for operation of electrostatic precipitators. In such use they are connected to a sophisticated, automatic primary control system complete with overload protection, secondary current sensing and spark sensing and limiting circuitry which effectively prevents the occurrence of conditions which would cause explosions within the tank.

Operating experience since the early 1900's in thousands of applications has yielded no known occurrences of explosions of electrostatic precipitator power supplies.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Total exemption from all requirements of Article 450 is not justified in view of the possible significant amount of combustibles involved.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-2 (New): Accept

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the hearing and that the panel put the references to the various standards into fine print notes rather than a mandatory requirement.

SUBMITTER: 33 (CMP 1) Add a new paragraph after Exception No. 2 as follows:

As follows: The term fire resistant means a construction having a minimum fire rating of one hour, unless specified otherwise according to ASTM Standard E 119-75; Fire Tests of Building Construction and Materials, NFPA 251-1972; also Methods of Fire Tests of Building Construction and Materials ANSI A2.1-1972.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-3: Reject

SUBMITTER: H. K. Glenn, Pacific Coast Electrical Assn.

PROPOSAL: 3 Delete the entire sentence and rewrite to read: Where the rated primary of a transformer is 9 amperes or more, an overcurrent device rated or set at not more than 125 percent of this current rating shall be permitted. (The rest of the section to remain unchanged.)

SYNOPSIS: There are problems in this area in the interpretation of this section as to when secondary overcurrent protection is required. We believe this addition will correct the problem, also it is consistent with the Exception No. 5 of Section 240-3.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
214 and NEMA Standard KS-1-1969 Section 2.80(b) states:

"A fused switch shall be marked as a part of the electrical equipment."

Therefore, the maximum load that could be supplied is 80 amp or 100 percent of the transformer design capacity.

The proposal would allow 100 percent use of transformer design capacity and be consistent with similar provisions for motors (Section 430-55) and conductors (Section 240-5, Exception No. 1). The comment draws a lot of sympathy in that the 80 percent continuous duty factor permitted only 96 percent of the transformer rating. Just because the 125 percent mistake has been made in the past and may be repeated, it seems that we have not only lost a partial but a great deal of the safety when this protection can be increased to 150 percent of the rating of the transformer when it is for the purpose of recovering only 4 percent of the transformer design capacity.

The last paragraph of the 1974 preprint supporting comments included herein is not only in error, it serves as the piece of wool over the eyes because it actually permits from 120 to 150 percent loading of the transformer instead of the 100 percent with the permitted 125 percent factor.

Just because the 125 percent mistake has been made in the past and has warped all face values out of proportion to where accuracy ratings are becoming a farce, are we committed to continue to do so especially when transformers of 112 1/2 kVA are not only lost a partial but a great deal of the safety when this protection can be increased to 150 percent of the rating of the transformer when it is for the purpose of recovering only 4 percent of the transformer design capacity.

The proposal would allow 100 percent use of transformer design capacity and be consistent with similar provisions for motors (Section 430-55) and conductors (Section 240-5, Exception No. 1). The comment draws a lot of sympathy in that the 80 percent continuous duty factor permitted only 96 percent of the transformer rating. Just because the 125 percent mistake has been made in the past and may be repeated, it seems that we have not only lost a partial but a great deal of the safety when this protection can be increased to 150 percent of the rating of the transformer when it is for the purpose of recovering only 4 percent of the transformer design capacity.

The last paragraph of the 1974 preprint supporting comments included herein is not only in error, it serves as the piece of wool over the eyes because it actually permits from 120 to 150 percent loading of the transformer instead of the 100 percent with the permitted 125 percent factor. Actual in the field experience is that the overcurrent device is loaded properly to 80 percent (continuous load). Overcurrent protection is an item the Code relies on as a safety factor when something out of the ordinary develops or is faulted into a circuit. It seems that we have not only lost a partial but a great deal of the safety when this protection can be increased to 150 percent of the rating of the transformer when it is for the purpose of recovering only 4 percent of the transformer design capacity.
450-23: Accept

Secretary's Note: It was the action of the Correlating Committee that further consideration be given to the comments expressed in the voting.

SUBMITTER: CMP

PROPOSAL: 15A Revise first paragraph to read:

High Fire Point Liquid Insulated Transformers. Transformers installed with insulated with a liquid identified for use in noncombustible buildings of a specific height, housing noncombustible occupancies, and having a fire point not less than 300°C shall be permitted to be installed without an automatic fire extinguishing system or vault. No increase in safety has been gained by the elimination of an automatic fire extinguishing system or vault.

Delete second paragraph.

SUBSTANTIATION: The intent of the Task Force is lost in the proposal as it is worded. An exception is made to clarify the total concept. Tests conducted by Factory Mutual Research indicate that some of the transformer installations have been made in significant quantities in non-combustible buildings without automatic fire extinguishing systems depending on the heat release rate of the liquid and the height of the building.

The following is recommended: 450-23

Exceptions: Transformers insulated with list fluids suitable for use in a non-combustible building and a non-combustible occupancy area shall be permitted to be installed without an automatic fire extinguishing system or vault. (Remaining text of Proposal 15A - as is).

THOMAS: To approve this CMP recommendation, which would require that all liquid-filled transformers containing a liquid with a fire-point not less than 300°C be diked and sprinkled, would be to ignore work that has been done and is still underway at Factory Mutual Research. FMR is now evaluating substitute fluids and the surface area of the containment (curbing).

The intent of the Task Force is lost in the proposal as it is worded.

ROBINSON: The purpose of this and similar proposals to the 1981 and earlier codes has been to promote the acceptance of a new a safe alternative to conventional insulation fluid for use outside of vaults. While we believe the wording proposed here is too restrictive, until such authorities as F.M. and U.L. resolve the technical issues, we have no alternative, in the interest of safety, but to support the Panel.

EXPLANATION OF VOTE

NEGATIVE: Boyd, Mattson, Thomas, Tudor.

AFFIRMATIVE: Boyd, Mattson, Thomas, Tudor.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-23: Reject

Secretary's Note: It was the action of the Correlating Committee that this Proposal be correlated with Proposal No. 15A.

SUBMITTER: CMP

PROPOSAL: 15A Revise as follows:

Transformers installed indoors or outdoors. The required protection of such a transformer installation is described in the "approval principles" which relates fire characteristics of liquids to potential fire hazards of transformers and determines which insulating liquids can be used and the protection if required. Transformers rated over 35,000 volts and used indoors shall be installed in a vault.

SUBSTANTIATION: See the TSC "findings" under the definition of "approved for the purpose" in Article 100.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-23: Accept

PROPOSAL: 18 In the first paragraph add nominal after "35,000 volts."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
450-23. High Fire Point Liquid-insulated Transformers.
Transformers insulated with a nonpropagating liquid approved for the purposes of this article, a nonpropagating liquid shall be one which, when subjected to a source of ignition, may burn but the flame will not spread from the source of ignition.
In this description the terms "high fire point liquid" and "nonpropagating" do not adequately describe the above fire characteristics of a liquid nor the associated fire hazard in their electrical use environment.

The proper description of the fire properties of a liquid must be strongly connected with the term "approved for the purpose." This term is defined in Article 100 as follows:
Approved for the Purpose: Approved for a specific purpose, environment, or application described in a particular Code requirement.
Suitability of equipment or materials for a specific purpose, environment or application may be determined by a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation as part of its listing and labeling program. (See "Labeled" or "Listed").
Labeled: Equipment or materials having a label, symbol, or other identifying mark of a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.
Listed: Equipment or materials included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or materials meet nationally recognized standards or has been tested and found suitable for use in a specified manner.
For the purposes of this article means for identifying listed equipment may vary for each testing laboratory, inspection agency or other organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

Approval Principle: The term approval principle implies a third party determination of selected fire characteristics, of approved liquids and of required protection. We believe at the present UL and FM have the capability to perform this function.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 15A.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-24: Reject

SUBMITTER: Charles B. Kish, The Travelers Insurance Co.
PROPOSAL: 19 Add a new second paragraph as follows: Areas containing Askarel transformers should never have drain or other pipe holes to the outside that would allow liquid to escape.
20 Proper diking or other means of containing total liquid spillage should be constructed. Handling and disposal of spilled liquid should be in legal guidelines.
SUBSTANTIATION: "Askarel" is a PCB (polychlorinated biphenyl) which is sometimes mixed with chlorobenzene to give particular viscosity characteristics. PCB has been on the E.P.A. (Environmental Protection Agency) Toxic Pollutant List for several years. It is an incredible stable chemical composition that could gradually accumulate in certain ecological systems. Any spillage would be a hazard to health and expensive to clean up.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: This Proposal could result in conflict with later EPA Guidelines.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-25: Exception No. 2: Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 21 In the penultimate line add "nominal" after "35,000 volts."

SUBSTANTIATION: To obtain uniformity of voltage levels and ratings throughout the Code.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The present wording adequately reflects the intent.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-26: Accept

Secretary's Note: It was the action of the Correlating Committee that it questions the need for all of the diagrams and requests the Panel to review them to see if they can be removed.

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 22 Revise as follows:

450-26. Oil-Insulated Transformers Installed Outdoors.

Oil-Insulated transformers shall not be installed.
1. Within 3 feet horizontal distance of any building wall.
2. Within 10 feet horizontal distance of any required exit.
3. Within 20 feet vertical distance of any building overhang.
4. Within 10 feet radial distance of any window.

The authority having jurisdiction may consider fire-resistive barrier, alternate sprinkler systems, etc., as equivalent protection for the conditions so indicated.

SUBSTANTIATION: The vagueness of this language renders this section legally unenforceable: See the attached opinion of the San Diego City Attorney.

*See Border County Div. IAEI substantiation for proposal for 110-16(a).

PANEL RECOMMENDATION: Accept as Revised.

450-26. Oil-Insulated Transformers Installed Outdoors.

Combustible material, combustible buildings and parts of buildings, fire escapes, and doors and window openings shall be safeguarded from fires originating in oil-insulated transformers installed on roofs, attached to, or adjacent to a building or combustible material in conformance with the following:
(a) Space Separation for Non-Combustible Construction.

Oil-Insulated transformers shall be permitted to be located directly adjacent to non-combustible walls provided the following clearances are maintained from doors, windows and other building openings:

1. Oil-insulated transformers shall not be located within a zone extending 20 feet outward and 10 feet to either side of a building door. See Figure 1.

2. Oil-insulated transformers shall not be located within a zone extending 10 feet outward and 10 feet to either side of an air intake opening. If the air intake opening is above the transformer, there shall be a 25 feet vertical distance from the opening to the transformer. See Figure 2.

3. Oil-insulated transformers shall not be located within a zone extending 10 feet outward and 3 feet to either side of a building window or opening other than an air intake. See Figure 3.
Where the space separations cannot be attained, fire resistant barriers or automatic water spray systems shall be permitted to be installed as safeguards. Where a barrier is used, it shall extend to a projection line from the corner of the transformer to the furthest corner of the window, door or opening. The height of the barrier shall be 1 foot above the top of the transformer. See Figures 4 and 5.

(b) Space Separation for Combustible Construction.

(1) Oil-insulated transformers rated 100 kVA or less shall be located according to the provisions set forth for noncombustible construction.

(2) Oil-insulated transformers of more than 100 kVA rating shall be located according to the provisions set forth for noncombustible construction but not closer than 10 feet from the building wall.

(3) Where a roof of combustible material or an overhang of combustible material is more than 20 feet above the top of an oil-insulated transformer, the required horizontal distances shall be measured from the building wall. See Figure 6 - Dimension "A".

Where a roof of combustible material or an overhang of combustible material is less than 20 feet above the top of an oil-insulated transformer, the required horizontal distances shall be measured from the farthest projection of the overhang. See Figure 6 - Dimension "B".

(f) On Poles, Structures or Underground. Transformers installed on poles, structures or underground shall conform to the National Electrical Safety Code, ANSI C2-1977.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 12
NEGATIVE: Jefferson, Mattson, Thomas.

EXPLANATION OF VOTE:

JEFFERSON: Since proposed revision provides additional detail, there is no technical substantiation for the selected dimensions.

450-26, FPN-(New): Reject

SUBMITTER: Samuel S. Levinrad, VA, Wash., DC

PROPOSAL: 23 Add a fine print note as follows:

Transformer high pressure relief valves and high voltage current limiting fuses are recognized safeguards for preventing catastrophic transformer failure.

SUBSTANTIATION: It is recommended that Section 450-26, Oil-insulated Transformers Installed Enclosures, be revised to be consistent with the latest technology and established engineering practice. Oil-insulated transformers (padmount transformers) are presently being installed adjacent to school buildings, townhouses and single family residences. They are installed in shopping center parking lots and in other areas readily accessible to the general public.

Section 450-26 reflects the recommendations contained in "Recommended Good Practice for Transformer and Switchgear Installations", published by Factory Mutual Insurance Company. At the time that this document was written, it was the only guide for designers with respect to fire safety. However, we feel it should have been updated. Since the National Electrical Code and NFPA have no jurisdiction in the updating of the aforementioned document, it is our feeling that the National Electrical Code should become current with present day practices. Today's emphasis for increased safety margins on high voltage distribution systems has led to a rapid growth in the use of current-limiting fuses for the protection of distribution systems.

Available distribution system fault current has increased significantly because system voltages have increased, and higher MVA capacity station transformers are being installed. As a result, tremendous amounts of energy can be fed into a fault. If the fault occurs in a transformer, there is the possibility of a disruptive failure endangering life and property. Current-limiting fuses offer a unique advantage in their ability to limit the let-through current and energy within safe limits with silent, non-venting operation. Thus, increased emphasis on safety (accelerated by the development of padmounted equipment which can be applied in close proximity to the general public) has caused utility engineers to specify current-limiting fuses to prevent potentially violent tank failures. When a current-limiting fuse is applied to a circuit, not only can the current be substantially limited, but the arcing time is also decreased. It follows then that the energy imparted to a fault can be substantially reduced, since it is proportional to the let-through current squared and the total clearing time. This reduction of energy makes it possible to protect distribution equipment from disruptive failures and hence to improve system safety margins. Consequently, the ability of the transformer to withstand faults without catastrophic failure can be immensely improved through the proper application of current-limiting
450-27-(New): Reject

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 25 Add new section as follows:

450-27. Installation of Transformers in Outdoor Enclosure: General. Where transformers are installed in an outdoor enclosure, the enclosure shall consist of a substantial fence not less than 8 feet high. The fence shall be so constructed that persons cannot readily climb it. Where any exposed current-carrying part is more than 8 feet above the ground, the height of the fence shall be not less than 10 feet, unless the fence is located more than 5 feet horizontally from the nearest such current-carrying part. Where the fence is of metal, it shall be provided in accordance with Article 450. The gate shall be self-locked, and a permanent sign indicating at 12 feet shall be posted on the gate, forbidding unauthorized persons to enter. No fence shall be required where all current-carrying conductors and parts entering the transformers are lead-sheathed and protected from physical damage, or are enclosed in metal raceway; the sheath, or the metal raceway, shall be wiped-in or screwed to the transformer cases, making a watertight construction, and all sheaths or raceways and the cases of the transformers shall be effectively grounded.

When the enclosure is adjacent to platforms, balconies, roofs, windows or doors, suitable screens shall be provided to prevent persons coming in contact with current-carrying parts, or bringing conducting materials into contact with them.

SUBSTANTIATION: The use of the word "practicable" renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

26 Add new section as follows:


SUBSTANTIATION: The vagueness of this language renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-29-(New): Reject

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 27 Add new section as follows:

450-29. Installation of Transformers on a Roof. Transformers may be installed on the roof of a building, where the structure of the building is of sufficient strength to carry the additional weight of the transformers and their enclosures and the equipment used in connection therewith under the following conditions:

(a) Dry-type and askarel-insulated transformers shall be in approved weatherproof enclosures.

(b) Where oil-insulated transformers are installed and the roof is of two-hour fire-resistant construction, the enclosure shall conform to Sub-article 450-C, as applicable. Where a fence enclosure is provided, a curb shall be provided high enough to contain the oil from the largest of the oil-filled transformers, but in no case less than six inches high. A drain shall be provided from the enclosures to carry any oil which it may contain well away from the building. Where the roof is not of two-hour fire-resistant construction, the enclosures shall conform to Sub-article 450-C, as applicable.

SUBSTANTIATION: The use of the word "practicable" renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
450-43: Exception: Accept

SUBMITTER: Arthur F. Cichy, Fenwal, Inc., Ashland, MA

PROPOSAL: 31 Revise exception as follows:

Exception: Where transformers are protected with automatic sprinkler, water spray, carbon dioxide or halon, construction of one-hour rating shall be permitted.

SUBSTANTIATION: The present wording of Article 450-43(b) does not adequately protect against the escape of PCB-based transformer cooling fluids into the environment. The proposed additional paragraph specifies vault construction so that the liquid-cooled transformers sometimes contain a cooling fluid which is based on PCB.

The present wording in Article 450-43(b) does not adequately protect against the escape of PCB-based transformer cooling fluids into the environment. The proposed additional paragraph specifies vault construction so that the liquid-cooled transformers sometimes contain a cooling fluid which is based on PCB.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-43(b): Reject

SUBMITTER: D. F. Wartok, Fort Wayne, IN

PROPOSAL: 32 Add a new paragraph to existing subpart (b) as follows:

A vault for transformers using PCB-based cooling fluid shall have a door sill or curb of sufficient height to confine within the vault the fluid from all of the transformers. End of conduits extending through the floor shall be at a height not less than the door sill or curb height.

SUBSTANTIATION: The Federal Toxic Substances Control Act contains specific requirements regarding the handling and disposal of polychlorinated biphenyls, commonly known as PCB's which are considered hazardous to the environment. Large liquid-cooled transformers sometimes contain a cooling fluid which is based on PCB.

The present wording in Article 450-43(b) does not adequately protect against the escape of PCB-based transformer cooling fluids into the environment. The proposed additional paragraph specifies vault construction so that the liquid-cooled transformers sometimes contain a cooling fluid which is based on PCB.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

450-45(e): Accept

SUBMITTER: J. Brooks Sample, ASHEAE/NFPA Std. 90A

PROPOSAL: 33 Delete "automatic closing dampers of not less than No. 10 MSG steel." Insert "Fire dampers which comply with Paragraph 3-3.7.1.2 of NFPA 90A shall be used on fire-rated vaults.

SUBSTANTIATION: 1. Present wording does not comply with other NFPA standards

2. 10G5G steel is a material specification and there is no substantiation of its effectiveness to stop fire.

3. Para. 3-3.7.1.2 is a performance specification which includes substantiation of its effectiveness.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

460-46: Exception-New: Reject


PROPOSAL: 34 Add a new exception for:

Exception: Areas containing Askarel transformers should never have drain or other pipe holes to the outside that would allow liquid to escape. Proper drainage means of containing total liquid spillage should be constructed. Handling and disposal of spilled liquid should be to legal guidelines.

SUBSTANTIATION: Askarel is a PCB (polychlorinated biphenyl) which is sometimes mixed with chlorobenzene to give particular viscosity characteristics. PCB has been on the EPA (Environmental Protection Agency) Toxic Pollutant List for several years. It is an incredible stable chemical composition that could gradually accumulate in certain ecological systems. Any spillage would be a hazard to health and expensive to clean up.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

460-XX: Reject

SUBMITTER: R. C. Cathcart, Kalamazoo, MI

PROPOSAL: 35 Amend Section 450 to state specifically the intent of the NEC with respect to protecting the primary and secondary transformer windings (themselves) from overcurrent, with the object being to make a clear distinction from the overcurrent construction for the primary and secondary circuit conductors which are involved with transformer installations. This should focus on whether transformers designed for a balanced load should, necessarily be protected against possible damage from arbitrarily applying an unbalanced load which does not exceed the nominal rated load of the transformer but may seriously over-load portions of its windings.

SUBSTANTIATION: I believe that the trade magazines, in the last year or so, have cultivated a hopeless state of confusion in the minds of many engineers and transformers by virtue of the Code requirements which apply to the installation of transformers. In essence, the thrust of the published articles seems to have it that the Code required primary overcurrent protection called for in Section 450 must be augmented, as a general rule, by secondary-side overcurrent devices to protect the secondary circuit conductors to conform to Section 260 regardless of the ampacity of these conductors, the rating of the transformer or the maximum current that the primary overcurrent would permit to become available to be secondary terminals under any arbitrarily imposed load conditions.

It seems to be ignored, that there is generally no reason to expect that a transformer vault could ever have the load spontaneously revert to any seriously unbalanced condition due to some secondary circuit defect. In other words, there is no reason to expect that the complication of added expense of providing secondary overcurrent protection can be justified as anything other than an academic argument. In the final analysis, any person sufficiently inept to intentionally apply a seriously unbalanced load to a susceptible transformer could be expected to also bypass the safeguards intended to protect either the transformer or circuit conductors.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 460 -- CAPACITORS

460-5(a): Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 36 In the second line add "nominal" after "50 volts."

SUBSTANTIATION: To comply with the Technical Subcommittee recommendation on nominal voltages.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

460-7: Accept

SUBMITTER: J. J. Kark, National Electrical Manufacturers Assn.

PROPOSAL: 37 Revise as follows:

460-7: Power Factor Correcting Motor Circuit. The total kilovolt rating of capacitors that are connected on the load side of a motor controller shall not exceed the value required to raise the no-load power factor of the motor to unity.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

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450-43, Exception: Accept    CMP 13
SUBMITTER: Arthur F. Cichy, Fenwal, Inc., Ashland, MA
PROPOSAL: 31 Revise exception as follows:
Exception: Areas protected with automatic sprinkler, water spray, carbon dioxide or halon, construction of one-hour rating shall be permitted.

STIPULATION: Article 450-13 contains specific requirements regarding the handling and disposal of polychlorinated biphenyls, commonly known as PCBs, which are not specified in the Exception.

PANEL RECOMMENDATION: Accept. Unanimously Affirmative.

450-43(b): Reject    CMP 13
SUBMITTER: D. F. Wartzok, Fort Wayne, IN
PROPOSAL: 32 Add a new paragraph to existing subpart (b) as follows:
A vault for transformers using PCB-based cooling fluid shall have a door sill or curb of sufficient height to contain within the vault the fluid from all of the transformers. End of conduits extending through the floor shall be at a height not less than the door sill or curb height.

SUBSTANTIATION: The Federal Toxic Substances Control Act contains specific requirements regarding the handling and disposal of polychlorinated biphenyls, commonly known as PCBs, which are not included in the Exception.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: This Proposal could result in conflict with NFPA Standards.

TOLERANCE GUIDELINES: Unanimously Affirmative.

450-45(e): Accept    CMP 13
SUBMITTER: J. Brooks Sample, ASHRAE/NFPA Std. 90A
PROPOSAL: 33 Delete “automatic closing dampers of not less than No. 10 MSG steel.” Insert “Fire dampers which comply with Paragraph 3-3.7.1.2 of NFPA 90A.”

SUBSTANTIATION: (1) Present wording does not comply with other NFPA standards.

2. 10MSG steel is a material specification and there is no substantiation of its effectiveness to stop fire.

3. Para. 3-3.7.1.2 is a performance specification which includes substantiation of its effectiveness.

PANEL RECOMMENDATION: Accept.

PANEL COMMENT: This Proposal could result in conflict with NFPA Standards.

450-46, Exception-(New): Reject    CMP 13
SUBMITTER: Charles B. Kish, The Travelers Insurance Co.
PROPOSAL: 34 Amend Exception (a) as follows:
Exception: Areas containing Askarel transformers should never have drain or other pipe holes to the outside that would allow liquid to escape. Proper drainage means of containing total liquid spillage should be constructed. Handling and disposal of spilled liquid should be to legal guidelines.

SUBSTANTIATION: It seems to be ignored, that there is generally no reason to expect that a transformer utilizing cooling fluids from all transformers in a vault (instead of just the largest) will be adequately retained in case of transformer tank rupture or leakage until it can be cleaned up.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: This Proposal could result in conflict with Tolerable Guidelines.

TOLERABLE GUIDELINES: Unanimously Affirmative.

450-XX: Reject    CMP 13
SUBMITTER: R. C. Cathcart, Kalamazoo, MI
PROPOSAL: 35 Amend Section 450 to state specifically the intent of the NEC with respect to protecting the primary and secondary transformer windings (themselves) from overcurrent, with the object being to make a clear distinction from the overcurrent conditions for the primary and secondary circuit conductors which are involved with transformer installations. This should focus on whether transformers designed for a balanced load should, necessarily be protected against possible damage from arbitrarily applying an unbalanced load which does not exceed the nominal rated load of the transformer but may seriously over-load portions of its windings.

STIPULATION: I believe that the trade magazines, in the last year or so, have cultivated a hopelessly state of confusion in the minds of many electricians regarding the Code requirements which apply to the installation of transformers. In essence, the thrust of the published articles seems to have it that the Code required primary overcurrent protection called for in Section 450 must be augmented, as a general rule, by secondary-side overcurrent devices to protect the transformer secondary circuit conductors in conformity to Section 260 regardless of the ampacity of these conductors, the rating of the transformer or the maximum current that the primary overcurrent would permit to be available to be secondary terminals under any arbitrarily imposed load conditions.

It seems to be ignored, that there is generally no reason to expect that a transformer utilizing a normally balanced load will ever have the load spontaneously revert to any seriously unbalanced condition due to some secondary circuit defect. In other words, there is no reason to expect that the complication or added expense of providing secondary overcurrent protection can be justified as anything other than an academic argument.

In the final analysis, any person sufficiently inept to intentionally apply a seriously unbalanced load to a susceptible transformer could be expected to also bypass the safeguards intended to protect either the transformer or circuit conductors.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The Panel is uncertain of the intent of the Proposal.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 460 -- CAPACITORS

460-6(a): Accept    CMP 13
SUBMITTER: TSC-Nominal Voltage
PROPOSAL: 36 In the second line add “nominal” after “50 volts.”

SUBSTANTIATION: To comply with the Technical Subcommittee recommendation on nominal voltages.

PANEL RECOMMENDATION: Accept.

PANEL COMMENT: This Proposal could result in conflict with Tolerable Guidelines.

TOLERABLE GUIDELINES: Unanimously Affirmative.

460-Part A: Accept    CMP 13
SUBMITTER: J. J. Kark, National Electrical Manufacturers Assn.
PROPOSAL: 37 Revise as follows:
460-7. Power Factor Corrector-Motor Circuit. The total kilovar rating of capacitors that are connected on the load side of a motor controller shall not exceed the value required to raise the no-load power factor of the motor to unity. Capacitors so connected shall be permitted only in applications where the motor is not subject to unusual switching service such as plugging, rapid reversals, reclosings, jogging, or other similar operations which could generate over-voltages and over-torques.

Delete the exception.

SUBSTANTIATION: The service conditions cited in italicized "Exception" as not permitted when capacitors not exceeding 50 percent of the kVA rating of the motor input are used are equally unacceptable when capacitor rating is selected on basis of limiting motor no-load power factor to unity. We believe these application guides have been followed in the past when using capacitors for factor power correction. Citing the unacceptable service conditions only in the italicized "Exception," by inference, implies such service conditions are acceptable when capacitor rating is set to limit motor no-load power factor to unity. With capacitor ratings so set and with capacitors connected on load side of motor controller, over-voltages and over-torques could also be generated by the motor itself from plug-in, rapid reversals, reclosings, jogging, etc.

The capacitor ratings up to 50 percent of the kVA rating of the motor input are permitted to be connected on load side of motor controller, the motor is subjected to an over-voltage limited only by the saturation time of the motor is disconnected. These over-voltages may range from 1.2 to 1.6 times normal voltage and will contribute to premature failure of the motor insulation system.

Moreover, setting capacitor rating as 50 percent of the kVA rating of the motor input does not afford, in most cases, an appreciable gain in power factor over that achieved by setting capacitor rating to limit no-load power factor to unity. In support of the preceding sentence, Exhibit A (attached)
The most important reason for this change is that single pole switching of low voltage capacitors is hazardous. Single pole equipments are usually open type knife switches where normal switching or closing on faults could cause arcs, splattering molten metal or flying parts. The workman may not open all ungrounded poles and leave the capacitor energized when it should be de-energized.

PANEL RECOMMENDATION: Accept as Revised

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

ARTICLE 470 -- RESISTORS AND REACTORS

470, Part A: Reject

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 40 Revise the title as follows:

SUBSTANTIATION: To obtain uniformity of voltage levels and ratings throughout the Code.

PANEL RECOMMENDATION: Reject

PANEL COMMENT: The present wording adequately reflects the panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

ARTICLE 710 -- OVER 600 VOLTS, NOMINAL GENERAL

710-2: Reject

SUBMITTER: H.K. Glenn, Pacific Coast Electrical Assn.

PROPOSAL: 41 Revise as follows:

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

710-2: Accept

SUBMITTER: TSC-Skin Effect Current Tracing

PROPOSAL: 42 Add the words "Article 364, Busways" to Article 710-2 after Article 427, Fixed Electric Heating Equipment for Pipelines and Vessels.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

710-2: Accept

SUBMITTER: CFP 13

PROPOSAL: 42A Add "Article 364, Busways" to Article 710-2 after Article 427, Fixed Electric Heating Equipment for Pipelines and Vessels.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

710-2: Accept

SUBMITTER: CFP 13

PROPOSAL: 43 Add "Article 364, Busways" to Article 710-2 after Article 427, Fixed Electric Heating Equipment for Pipelines and Vessels.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

710-3(a) and (b): Accept

SUBMITTER: H. F. van der Voot, Cleveland, OH

PROPOSAL: 43 Add the words "in rigid nonmetallic conduit" to the first sentence, paragraph "(a) Aboveground Conductors" after "in Intermediate metal conduit" and before "in cable trays.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative

710-3(a) and (b): Accept

SUBMITTER: H. F. van der Voot, Cleveland, OH

PROPOSAL: 44 Add the words "in rigid nonmetallic conduit" to the first sentence, paragraph "(a) Aboveground Conductors" after "in Intermediate metal conduit" and before "in cable trays.

PANEL RECOMMENDATION: Accept

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative
I PANEL RECOMMENDATION: Accept as Revised:
(a) raise motor no-load power factor to unity;
(b) equal 50 percent of the kVA rating of the motor input.
In the first two examples depicted, 7.5 HP, 1200 RPM & 10 HP, 900 RPM ratings, the motor no-load kVAR is more than 50 percent of the kVA rating of the motor input. In these cases, which are typical of ones having inherently low motor power factor and where power factor improvement is beneficial, the italicized "Exception" is simply not applicable and thus affords no potential for additional gain in power factor improvement.
In the second two examples, 40 HP, 1200 RPM & 200 HP, 1800 RPM ratings, corrective KVAR as value to raise motor no-load power factor to unity yields better power factor improvement up through 75 percent load than attained by corrective KVAR equal to 50 percent of the kVA rating of the motor input. For loads above 75 percent, the converse is true, but there is no notable overall difference in power factor improvement between the two approaches.

PANEL RECOMMENDATION: Accept as Revised:
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PROPOSAL: 41A Add the word "nominal" after 600 volts.
SUBSTANTIATION: The Pacific Coast Electrical Association has included in Section 710-2 interrupting rating and...
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 710 -- OVER 600 VOLTS, NOMINAL GENERAL

710-2: Accept
SUBMITTER: H.K. Glenn, Pacific Coast Electrical Assn.
SUBSTANTIATION: To be consistent with panel action on Proposal No. 4.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

710-2: Accept
SUBMITTER: TSC-Nominal Voltage
PROPOSAL: 42A Add "Article 364, Busways" to Article 710-2 after ARTICLE 427.
SUBSTANTIATION: To correlate with proposed revisions for Article 710-2.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

710-2: Accept
SUBMITTER: CMP 13
PROPOSAL: 42A Add "Article 364, Busways" to Article 710-2 after ARTICLE 427.
SUBSTANTIATION: To be consistent with panel action on Proposal No. 44.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

710-2: Accept
SUBMITTER: CMP 13
PROPOSAL: 42A Add "Article 364, Busways" to Article 710-2 after ARTICLE 427.
SUBSTANTIATION: To be consistent with panel action on Proposal No. 44.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 470 -- RESISTORS AND REACTORS

470, Part A: Reject
SUBMITTER: CMP 13
PROPOSAL: 43 Add the words "in rigid nonmetallic conduit" and before "in cable trays."
SUBSTANTIATION: In paragraph "(b) Underground Conductors," amend the last sentence before Table 710-3(b) by deleting the words "encased in not less than 3 inches of concrete."
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

470, Part A: Reject
SUBMITTER: H. F. van der Voort, Cleveland, OH
PROPOSAL: 43 Add the words "in rigid nonmetallic conduit" to the first sentence, paragraph "(a) Aboveground Conductors" after "in intermediate metal conduit" and before "in cable trays."
SUBSTANTIATION: Schedule 40 rigid PVC conduit is suitable in applications where the potential exceeds 600 volts. High voltage, high current fault circuits are conducted on 4 inch Schedule 40 Rigid PVC Conduit under a wide range of conditions. The results prove that the conduit exhibits little or no signs of deterioration or physical damage due to the explosions and high temperatures. The report of the results of...
ARTICLE 445 -- GENERATORS

445-1: Reject

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 1 Amend Section 445-1 to include Article 240.

SUBSTANTIATION: 240-21 tells us all conductors shall be protected at point of supply. The inherent design of a generator only protects the generator itself. Nowhere in Article 445 does it give any specific overcurrent protection for the conductor leading from the generator.

The generator can be changed in the field to a larger generator without any knowledge of conductor ampacity or overcurrent requirements thereby causing an overload on the conductors and creating a fire hazard. In some installations the conductors leading from the generator to the first overcurrent device is greater than 100 feet.

See Proposal No. 3 for 445-5.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Unduly restricting design for larger units where other methods to prevent overloading of conductors have shown to be adequate. Overcurrent protection should be as close as practicable, but 25 feet is too restrictive.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 7
NEGATIVE: 2

EXPLANATION OF VOTE:

FLACH: I agree that 25 feet may be too short for large machines, but there should be some statement in the Article which requires overcurrent protection for the conductors connected to the generator.

SCALONE: The installation of an unprotected feeder for greater distances within a building might cause a greater threat to human life such as fire, explosion or electrocution, than would be caused by the lack of emergency power. I suggest modifying the proposed wording:

"The length of exposed feeder installed from the generator terminals to the first overcurrent protective device shall not exceed 25 feet."

445-6: Accept

SUBMITTER: H. K. Glenn, Pacific Coast Electrical Assn.

PROPOSAL: 2 Revise by adding "and neutral" after "phase conductors." This sentence will then read: "The ampacity of the conductors leading from the generator terminals to the first overcurrent device shall not be less than 115 percent of the nameplate current rating of the generator."

SUBSTANTIATION: Clarification.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: CMP 22 agrees with the intent of the Proposal see action on Proposal No. 2A, Section 445-5.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

445-5: Accept

SUBMITTER: CMP 22

PROPOSAL: 2A Add a sentence to the end of 445-5 as follows:

"The ampacity of the neutral conductors in accordance with Section 220-22. Conductors which must carry ground-fault currents shall not be smaller than required by Section 250-23(b)."

PANEL COMMENT: Where the generator neutral is not grounded at its terminal, the neutral conductor must be of adequate size to carry ground-fault current.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

445-5: Reject

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 3 Amend Article 445-5 by adding another sentence stating: "The conductor shall not be over 25 feet in length and shall terminate with a single circuit breaker or a single set of fuses that will limit the load to the ampacity of the conductors."

SUBSTANTIATION: 250-5(d) states that generators are a separately derived system. If they are such we should have some rules for giving the conductors from the generator proper protection. These are the times when it is hard to install an overcurrent device at the generator location. If we used a 25 foot tap rule from the generator to the overcurrent device it would prevent installations of greater distance from the generator to the overcurrent device.

240-21 tells us all conductors shall be protected at point of supply. The inherent design of a generator only protects the generator itself. Nowhere in Article 445 does it give any specific overcurrent protection for the conductor leading from the generator.

See Proposal No. 1 for 445-1.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Unduly restricting design for larger units where other methods to prevent overloading of conductors have shown to be adequate. Overcurrent protection should be as close as practicable, but 25 feet is too restrictive.

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 8
NEGATIVE: 2

EXPLANATION OF VOTE:

FLACH: Separating this proposal as has been done in Proposal Nos. 21A through 21S should reduce this confusion between requirements for emergency, legally required stand-by, and optional stand-by systems.

SCALONE: Nothing was done to clarify the guidelines established by the NEC on nominal voltages.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 480 -- STORAGE BATTERIES

480-5(b): Accept

SUBMITTER: CMP TSC-Nominal Voltage

PROPOSAL: Add "nominal" after "24 volts" to read "(24 volts, nominal)."

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 700 -- EMERGENCY SYSTEMS

Article 700: Reject

SUBMITTER: H. K. Glenn, Pacific Coast Electrical Assn.

PROPOSAL: 6 Combine Articles 700 and 750.

SUBSTANTIATION: To adopt the report of CMP TSC to combine Articles 700 and 750. Complete text as shown on pages 391, 392, 393, 394 of the "Preprint of the proposed amendments for the 1978 National Electrical Code."

TSC-NOMINAL VOLTAGE: The present separation of the articles, both of which deal with alternate power systems, is a source of confusion. The separation between various sources and distribution systems intended to be functional when normal power supplies are disrupted, is illogical and is a source of conflict in application and enforcement.

The TSC report was well conceived and the integrated subject matter provides a much more coherent coverage of Alternate Power Systems. The supporting comment by CMP 22 which accompanied the proposal thoroughly covers the subject and is still pertinent.

The Correlating Committee (see Secretary's note) apparently agreed with the developed material, but unfortunately the assignment to "process new material in the appropriate articles" was not accomplished. Their action to pull apart the work of the TSC would be ill-advised and would destroy the logical arrangement.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See CMP action on Proposal No. 7. The Correlating Committee has instructed CMP 22 to keep the articles separate.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

EXPLANATION OF VOTE:

FLACH: Separating this proposal as has been done in Proposal Nos. 21A through 21S should reduce this confusion between requirements for emergency, legally required stand-by, and optional stand-by systems.

470-700-(New) NO. 1978 NEC): Reject

SUBMITTER: CMP 22

PROPOSAL: 7 Report of CMP TSC to combine Articles 700 and 750 asfollows:

ARTICLE 700 -- ALTERNATE POWER SYSTEMS

A. GENERAL

700-1. Scope. The provisions of this Article apply to the installation, operation, and maintenance of systems consisting of circuits and equipment intended to distribute and control electricity for illumination and/or power when the normal supply or system is interrupted. Unless specifically referenced, these provisions do not apply to health care facilities which are covered by Article 517.

700-2. An alternate power system shall be classified as one of the following:
I PANEL RECOMMENDATION: Accept as Revised:

G in Article 500 of the NEC were classified according to:

Test Equipment Panel, staffed by prominent experts who studied
the attached report.*

Electrotechnical Commission test method by Working Group No. 2
National Electrical Code.

SUBMITTER: E. C. Magison, Honeywell Inc.

PROPOSAL: 1A. Add the following at end of fine print note
referring to NFPA No. 493: and installation of Intrinsically
Safe Instrument Systems in Class I Hazardous Locations ANSI/ISA
RP 12.6-1976.

SUBSTANTIATION: No reference or information on installation
requirements for intrinsically safe systems. ANSI/ISA RP 12.6
is such a Standard.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: Howard F. Kempshall, Chairman of NFPA Sectional
Committee on Classification of Laboratory Categories.

PROPOSAL: 2 Add new paragraph to fine print note as follows:
For electrical classification of laboratory areas, see Standard

SUBSTANTIATION: Chemistry Laboratories have traditionally been
considered non-hazardous (non-classified) areas, as far as
electrical equipment is concerned. This recognizes the
relatively small quantities of flammable liquid that might be
involved in a spill and the presence of other more obvious
sources of ignition, such as hot plates or bunsen burners (both
of which are indispensable laboratory equipment).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 4 In Section 500-2(a) second line, delete the word
"explosion" and replace it with the words "explosive, combustible or ignitable."
In the third line delete the word "or," place a comma after the word "dust," and add "fiber or flyings."

The first paragraph of Section 500-2(a) would then read:

"Equipment shall be approved not only for the class of
location but also for the explosive, combustible, or ignitable
properties of the specific gas, vapor, dust, fiber or flyings
that will be present. In addition, equipment shall not have
exposed any surface that operates at a temperature in excess of
the ignition temperature of the specific gas, vapor, dust, fiber or flyings."

SUBSTANTIATION: Class III locations have an approval for class
properties as well as Class I and Class II locations. The
properties (fiber and flyings) of ignitibles in Class III
are therefore in accord with Proposal No. 18 as modified by the
Panel.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
I PANEL RECOMMENDATION: Accept as revised:

National Electrical Code as classified in the attached listing.*

500-2(a) as follows:

classification based on reliable scientific criteria and
within the National Electrical Code. The prevalence of dusts in
therefore recommended that these dusts be included in the
and better application of the National Electrical Code. It is
E, F, and G in the Code as well as by the data concerning dust
under contract by the Occupational Safety and Health
Handbook, 14th Edition, pages 3-107 through 3-114 be included in
Protection Handbook, classified as indicated.

SUBMITTER: E. C. Magison, Honeywell Inc.

fine print note a sentence.

characteristics."

Research Corp., that combustible elemental silicone described
materials. In an effort to determine the particular "Group"
"For Groups E, F and G, see Table 500-2(a)." Add now Table
read: "...or other dusts with similar hazardous
EXPLANATION OF VOTE:
VOTE ON PANEL RECOMMENDATION:
PANEL COMMENT: Reject in deference to Proposal No. 3.
PANEL RECOMMENDATION: Reject
better defining the National Electrical Code's Class II Groups.
Standard 12.10, or the development of a similar standard, to
assist institutions in correctly classifying their facilities by
classification of production facilities in which combustible
elemental silicon is present in a dust form. Dust particle size
ranges from 1 to 90 microns, with the bulk of samples at
approximately 35 microns.
Difficulty was encountered with the application of Section
500-2, describing the various "Groups" of hazardous dust
materials. In an effort to determine the particular "Group"
into which elemental silicon would fall, we turned to
definitions developed by the Instrument Society of America,
Standard S 12.10, dated 10/73, basing classifications upon
conductivities of dusts in controlled conditions.
It was discovered, as a result of tests performed by Hazards
Research Corp., that combustible elemental silicon described
above, behaves similar to agricultural, plastic and other
"non-conductive" dusts, lying well within "Group F.
We would also like to encourage the adoption of the ISA
Standard 12.10, or the development of a similar standard, to
assist institutions in correctly classifying their facilities by
better defining the National Electrical Code's Class II Groups.
PANEL RECOMMENDATION: Reject
PANEL COMMENT: Reject in deference to Proposal No. 3.
VOTE ON PANEL RECOMMENDATION:
AFFIRMATIVE: 17.
NEGATIVE: Adams.
EXPLANATION OF VOTE:
ADAMS: I think this proposal should be accepted, modified to
read: "...or other dusts with similar hazardous
characteristics."

SUBMITTER: Douglas R. Pratt, Dow Corning Corp.

PROPOSAL: 6
Revise fine print note as follows:
Group G: Atmospheres containing flour, starch, grain, or
other dusts with similar characteristics.
SUBSTANTIATION: Recently we have been involved in the
classification of production facilities in which combustible
elemental silicon is present in a dust form. Dust particle size
ranges from 1 to 90 microns, with the bulk of samples at
approximately 35 microns.
Difficulty was encountered with the application of Section
500-2, describing the various "Groups" of hazardous dust
materials. In an effort to determine the particular "Group"
into which elemental silicon would fall, we turned to
definitions developed by the Instrument Society of America,
Standard S 12.10, dated 10/73, basing classifications upon
conductivities of dusts in controlled conditions.
It was discovered, as a result of tests performed by Hazards
Research Corp., that combustible elemental silicon described
above, behaves similar to agricultural, plastic and other
"non-conductive" dusts, lying well within "Group F.
We would also like to encourage the adoption of the ISA
Standard 12.10, or the development of a similar standard, to
assist institutions in correctly classifying their facilities by
better defining the National Electrical Code's Class II Groups.
PANEL RECOMMENDATION: Reject
PANEL COMMENT: Reject in deference to Proposal No. 3.
VOTE ON PANEL RECOMMENDATION:
AFFIRMATIVE: 17.
NEGATIVE: Adams.
EXPLANATION OF VOTE:
ADAMS: I think this proposal should be accepted, modified to
read: "...or other dusts with similar hazardous
characteristics."

Secretary's Note: It was the action of the Correlating
Committee that the Panel make editorial adjustment to make the
fine print note a sentence.
SUBMITTER: E. C. Magison, Honeywell Inc.

PROPOSAL: 7
In the fourth paragraph after reference to Table
500-2(c) add: For groups E, F and G see Table 500-2(c). And add
new Table 500-2(a) to include the dusts now listed in the Fire
Protection Handbook, classified as indicated.
SUBSTANTIATION: It is recommended that the various dusts listed
in the National Fire Protection Association's Fire Protection
Handbook, 14th Edition, pages 3-107 through 3-114 be included in
the National Electrical Code. The National Academy of Sciences
under contract by the Occupational Safety and Health
Administration has classified the dusts within the scope Groups
E, F, and G in the Code as well as by the data concerning dust
resistivity (another recommendation).
There is a need for a more definitive dust classification
within the National Electrical Code. The prevalence of dusts in
industrial processes (i.e., plastic dust, wood dust, etc., which
are presently not classified) dictates a more precise
classification. Based on reliable scientific criteria and
information. This listing would facilitate easier referencing
and better application of the National Electrical Code. It is
therefore recommended that these dusts be included in the
National Electrical Code as classified in the attached listing.
"Attached listing supplied to CMP members.
PANEL RECOMMENDATION: Accept as revised:
The fourth paragraph after reference to Table 500-2 add:
"For Groups E, F and G, see Table 500-2(a)." Add new Table
500-2(a) as follows:

Table 500-2(a) Dusts by Groups

<table>
<thead>
<tr>
<th>Dust Type</th>
<th>Group E Atmospheres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals:</td>
<td>Aluminum, atomized collector fines</td>
</tr>
<tr>
<td></td>
<td>Aluminum, Fluorite, A 422 extra fine lining, polished</td>
</tr>
<tr>
<td></td>
<td>Boron, amorphous, commercial (95% B)</td>
</tr>
<tr>
<td></td>
<td>Iron, hydrogen reduced (99% Fe)</td>
</tr>
<tr>
<td></td>
<td>Iron, carbonyl (99% Fe)</td>
</tr>
<tr>
<td></td>
<td>Magnesium, milled, Grade B</td>
</tr>
<tr>
<td></td>
<td>Thorium (contains 1.2% Th)</td>
</tr>
<tr>
<td></td>
<td>Thorium hydride (contains 0.94% Th)</td>
</tr>
<tr>
<td></td>
<td>Tin atomized (98% Sn, 2% Pb)</td>
</tr>
<tr>
<td></td>
<td>Titanium (99% Ti)</td>
</tr>
<tr>
<td></td>
<td>Titanium hydride (95% Ti, 3.8% H)</td>
</tr>
<tr>
<td></td>
<td>Uranium</td>
</tr>
<tr>
<td></td>
<td>Uranium hydride</td>
</tr>
<tr>
<td></td>
<td>Vanadium (86.4% V)</td>
</tr>
<tr>
<td></td>
<td>Zirconium, prepared from hydride (contains 0.5% Zr)</td>
</tr>
<tr>
<td></td>
<td>Zirconium, hydride (93.6% Zr, 2.1% H)</td>
</tr>
<tr>
<td>Alloys and Compounds:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aluminum-lithium alloy (15% Li)</td>
</tr>
<tr>
<td></td>
<td>Aluminum-manganese alloy (Dowmetal)</td>
</tr>
<tr>
<td></td>
<td>Aluminum-silicon alloy (12% Si)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group F Atmospheres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonaceous Dusts:</td>
</tr>
<tr>
<td>Coal, hardwood mixture</td>
</tr>
<tr>
<td>Coal, Utah</td>
</tr>
<tr>
<td>Coal, pitch, coal tar</td>
</tr>
<tr>
<td>Coal, petroleum</td>
</tr>
<tr>
<td>Coal, Kentucky (Bituminous)</td>
</tr>
<tr>
<td>Coal, Pennsylvania, Pittsburg (Experimental Mine Coal)</td>
</tr>
<tr>
<td>Coke, lignite, California</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group G Atmospheres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Dusts:</td>
</tr>
<tr>
<td>Almond shell</td>
</tr>
<tr>
<td>Apricot pit</td>
</tr>
<tr>
<td>Cellulose</td>
</tr>
<tr>
<td>Cellulose, alpha</td>
</tr>
<tr>
<td>Cellulose, flocc, fine cut</td>
</tr>
<tr>
<td>Cherry pit</td>
</tr>
<tr>
<td>Citrullus</td>
</tr>
<tr>
<td>Citrus peel</td>
</tr>
<tr>
<td>Cocoa, natural 19% fat</td>
</tr>
<tr>
<td>Coconut shell</td>
</tr>
<tr>
<td>Coffee, full roasted</td>
</tr>
<tr>
<td>Corn</td>
</tr>
<tr>
<td>Corn cob grit</td>
</tr>
<tr>
<td>Corn, dextrose pure</td>
</tr>
<tr>
<td>Corn starch, commercial product</td>
</tr>
<tr>
<td>Corn starch (dry, ground, 50% moisture)</td>
</tr>
<tr>
<td>Cork dust</td>
</tr>
<tr>
<td>Cottonseed meal</td>
</tr>
<tr>
<td>Cube root, South American</td>
</tr>
<tr>
<td>Flax shive</td>
</tr>
<tr>
<td>Garlic, dehydrated</td>
</tr>
<tr>
<td>Grain dust, winter wheat, corn, oats</td>
</tr>
<tr>
<td>Guar seed</td>
</tr>
<tr>
<td>Gum, arabic</td>
</tr>
<tr>
<td>Gum, karaya</td>
</tr>
<tr>
<td>Gum, Nipa (copal)</td>
</tr>
<tr>
<td>Gum, tragacanth</td>
</tr>
<tr>
<td>Hemp hurd</td>
</tr>
<tr>
<td>Lycopodium</td>
</tr>
<tr>
<td>Malt barley</td>
</tr>
<tr>
<td>Milk, skimmed</td>
</tr>
<tr>
<td>Pea flour</td>
</tr>
<tr>
<td>Pecan shell, raw</td>
</tr>
<tr>
<td>Peanut hull</td>
</tr>
<tr>
<td>Pecan, shelled, sun dried</td>
</tr>
<tr>
<td>Pecan nut shell</td>
</tr>
<tr>
<td>Pectin (from ground dried apple pulp)</td>
</tr>
<tr>
<td>Potato starch, dextrinated</td>
</tr>
<tr>
<td>Pyrrhotinum, ground flour leaves</td>
</tr>
<tr>
<td>Raikofia vonsteria root</td>
</tr>
<tr>
<td>Rice</td>
</tr>
<tr>
<td>Rice bran</td>
</tr>
<tr>
<td>Rice hull</td>
</tr>
<tr>
<td>Rye flour</td>
</tr>
<tr>
<td>Rye starch, edible</td>
</tr>
<tr>
<td>Rye starch, treated</td>
</tr>
<tr>
<td>Rye, untreated</td>
</tr>
<tr>
<td>Wheat flour</td>
</tr>
<tr>
<td>Wheat, gluten, gum</td>
</tr>
<tr>
<td>Wheat starch, edible</td>
</tr>
<tr>
<td>Wheat starch, allyl chloride treated</td>
</tr>
<tr>
<td>Wheat straw</td>
</tr>
</tbody>
</table>
Group III. Natural Resins
Cashew oil phenolic, hard
Lignin, hydrolyzed-wood-type, fine
Rosin, Ok.
MILLER:Soldium resinate, dry size grade XXX

Group VI. Rubber
Rubber, crude, hard
Rubber, synthetic, hard, contains 33% sulfur

Group V. Miscellaneous Resins
Allyl ketone dimer sizing compound, dimer dispersed on silica (SO-50)
Chlorinated phenol (bis 2-hydroxy-5 chlorophenyl methane)
Ethylene oxide polymer
Ethylene-maleic anhydride copolymer
Styrene-maleic anhydride copolymer
Petrol acrylate monomer, crude

Add a fine print note at the end of Table 500-2(a) as follows:
"Atmospheres containing charcoal, coal or coke dusts which have more than 8 percent total volatile material (ASTM D071) or atmospheres containing these dusts sensitized by other materials so that they present an explosion hazard."

PANEL COMMENT: It is the Panel's view that it is inappropriate to expand the table of classified materials in the NEC. The number of hazardous gases, vapors and dusts is so great that the classifications should be given in another NFPA publication. Such a publication would also benefit the user because it could also explain the basis for the classification scheme. The Panel recommends strongly that documents such as Report NRAR 353-1, "Matrix of Combustion-Relevant Properties and Classification of Gases, Vapors and Selected Solids," published by the National Research Council be used as a basis for a new NFPA publication or a revision of Z612. However, because the public at present views the NEC as the source of material classifications, it is essential that the lists be included in the 1981 NEC.

VOTE ON PANEL RECOMMENDATION:
AFFIRMATIVE: 15.
NEGATIVE: Adams, Conaway, Ewers.

COMMENT ON VOTE:
HALL: Fine print should follow Group F.
MAGISON: I agree with proposal to list additional dusts, but believe that the addition of the FPN after the table is unnecessary because it duplicates information in the definitions of the Groups.
MILLER: The fine print note which is part of the Panel Recommendation needs some editorial adjustment to make it into a sentence.

EXPLANATION OF VOTE: ADAMS: I believe that this proposal should be rejected. The extensive table of dusts is something that should be in a handbook and not in the NEC. I do not believe in putting material in the NEC temporarily.
CONAWAY: The table material was not available prior to the May 1979, meeting so material could not be studied prior to the meeting. Great long lists of dust by catagory do not belong in the Code. Where will the list stop. Proposed list just scratches the surface of materials that could be listed. By listing certain materials, do we infer that anything not listed is nonhazardous. For certain resins and molding compounds, there is a breakdown by Group I -- X, etc. There is no explanation of what these are.
Ewers: Inclusion of all the materials listed is too restrictive in many cases. It would unnecessarily classify many locations that are not a fire or explosion hazard.

Table 500-2: Accept
SUBMITTER: E. C. Magison, Honeywell Inc.

PROPOSAL: Add the following materials in the Groups Indicated:
Arsine - B
Propyl Nitrate - B
Ethyl Mercaptan - C
Ethyl Sulfide - C
Hydrogen Cyanide - C
Ethylene Glycol Monomethyl Ether - D

SUSTAINATION: Under the auspices of the National Academy of Sciences, the Underwriters Laboratories Inc. has investigated arsine, ethylene glycol monomethyl ether, ethyl mercaptan, ethyl sulfide, hydrogen cyanide, and propyl nitrate for the purposes of classifying them within the National Electrical Code's hazardous locations, Groups A, B, C, and D. The results of the investigation are attached.
It is recommended, based on the Underwriters Laboratories Inc.'s investigation and test results, that these 6 chemicals be included in the revision of the NEC in the Groups, as designated in the report.

*Attachments have been supplied to CMP.

PANEL RECOMMENDATION: Accept.

Table 500-2: Accept
SUBMITTER: E. C. Magison, Honeywell Inc.

PROPOSAL: Add the following materials in the Groups Indicated:
Nonane - D
Cyclohexane - D
Cyclohexene - D
Methylcyclohexane - D
Turbentine - D
Butylene - D
1-Pentene - D
Hexene - D
Heptene - D
Octene - D
Nonene - D
Tripropylene - D
Decene - D
Dipentene - D
Undecene - D
Tetrapropylen - D
Tridecene - D
Tetradecene - D
Methylacetylene - C
Ethyl Benzene - D
Cumene - D
Cycene - D
Tert-butyloleune - D
Diethylbenzene - D
Styrene - D
α-Methylstyrene - D
Vinyltoluene - D
Liquified petroleum gas - D
Methyl acetylene - Propadiene (MAPP gas)-C
Naphtha, coal tar - D
Naphtha, petroleum - D
Stoddard solvent - D
0-Terphenyl - D
m-Terphenyl - D
p-Terphenyl - D
Isopropyl alcohol - D
Hexanol - D
Methyl amyl alcohol - D
Ethyl butanol - D
Methyl isobutyl carbinol - D
Methylycyclohexanol - D
Dibutyl alcohol - D
Propionaldehyde - C
Iso-butyraldehyde - C
Valeraldehyde - C
3-methyl butyraldehyde - C
iso-pentyl aldehyde - C
2-ethylhexaldehyde - C
iso octyl aldehyde - C
2-ethyl-3 propyl-acrolein - C
Glyoxal - C
Gluutaraldehyde - C
formic acid - D
Propionic acid - D
Acrylic acid (inhibited) - D
Acetic anhydride - D
Methyl formate - D
Ethyl formate - D
Methyl acetate - D
n-propyl acetate - D
isopropyl acetate - D
n-butyl acetate - D
sec-butylacetate - D
Tert-butylacetate - D
n-amylacetate - D
Isoamylacetate - D
sec-amylacetate - D
sec-hexylacetate - D
methyl acrylate - D
n-butyl acrylate (inhibited) - D
iso-butyl acrylate (inhibited) - D
methyl methacrylate - D
o-dimethyl phthalate - D
Butyl benzyl phthalate - D
Methyl formal - C
propyl formal - C
n-butylformal - C
iso-butyl formal - C
### Table 500-2: Accept CMP 14

<table>
<thead>
<tr>
<th>Submitter</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. J. Schram, Underwriters Laboratories</td>
<td>Accept</td>
</tr>
</tbody>
</table>

**SUBMITTER:** P. J. Schram, Underwriters Laboratories Inc.

**PROPOSAL:** Delete "sec-butyl alcohol" from the second column.

**SUBSTANTIATION:** Editorial correction. "sec-butyl alcohol" is the same material as "2-butan-2-yl alcohol (secondary butyl alcohol)" in the second column, second line of Table 500-2. Apparently when sec-butyl alcohol was added to Table 500-2 in 1978 Edition of NEC as per Proposal No. 10, fact that 2-butanol (secondary butyl alcohol) was already in Table 500-2 was overlooked.

**PANEL RECOMMENDATION:** Accept.

**VOTE ON PANEL RECOMMENDATION:** Unanimously Affirmative.

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### Table 500-2(a): Reject

<table>
<thead>
<tr>
<th>Submitter</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idaho Chapter IAEI</td>
<td>Reject</td>
</tr>
</tbody>
</table>

**SUBMITTER:** Idaho Chapter IAEI

**PROPOSAL:** Revise (a) as follows:

- Equipment shall be approved not only for the class of location but also for the "explosive, combustible, or ignitable" properties of the specific gas, vapor dust, "fiber or flyings" that will be present. In addition, equipment shall not have exposed any surface that operates at a temperature in excess of the ignition temperature of the specific gas, vapor, dust, "fiber, or flyings."

**SUBSTANTIATION:** Class III locations have an approval for class properties as well as Class I and Class II locations. The properties (fiber and flyings) of ignitables in Class III locations have been left out of the wording in this section and should not be excluded. The addition of the words "explosive, combustible, or ignitable" is the wording used in Section 500-4, 500-5 and 500-6 to describe the properties in Class I, Class II, and Class III locations.

**PANEL RECOMMENDATION:** Reject.

**VOTE ON PANEL RECOMMENDATION:** Covered by Proposal No. 4. Unanimously Affirmative.

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### Table 500-2(b): Accept

<table>
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<th>Submitter</th>
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<tr>
<td>G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operative Millers, J. Healy, Grain Elevator and Processing Society</td>
<td>Accept</td>
</tr>
</tbody>
</table>

**SUBMITTER:** G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operative Millers, J. Healy, Grain Elevator and Processing Society

**PROPOSAL:** Revise (a) as follows:

- (a) Approval for Class and Properties. In Class I locations, equipment shall be approved not only for the location but also for the explosion properties of the specific gas or vapor. In - Class II or III, Division 1 locations, equipment shall be approved for the dust-ignition-proof properties of the combustible dust or easily ignitable fibers or flying lines that will be present.

**REVISE (b) AS FOLLOWS:**

- (b) Marking. In Class I locations approved equipment shall be marked to show the Class, Group and operating temperature or temperature range, based on operation in a 40°C ambient. In - Class II and III, Division 1 locations approved equipment shall be marked to show the Class, Group and operating temperature or temperature range based on operation in a 40°C ambient.
Paragraph I and revise Exception No. 3 to read:

Approved equipment shall be marked to show the Class, Group, and operating temperature, or temperature range referenced to a 40°C ambient.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: Joseph L. Yosafat, General Electric Co.

500-2(a): Accept

SUBMITTER: R. Y. Newton, General Electric Co.

PROPPOSAL: 13: Revise first paragraph as follows:

"Approved equipment shall be marked to show the Class, Group, and operating temperature or temperature range, based on operation in a specified ambient temperature range, for which it is approved.

SUBSTANTIATION: The present statement regarding ambient temperature for equipment operation in Hazardous Locations first appeared in the 1971 Code when equipment marking of approved temperature ranges by identification numbers per Table 500-2b was adopted. It appears to say that the equipment is approved only if operating in a 40°C ambient temperature and no higher nor lower temperatures. This was the interpretation on occasion by Underwriters Laboratories.

UL adopted as standard in 1975 that Class 1 Group D & Class II Group E, F, and G motors approved for 40°C ambient hazardous locations were suitable for operation in an ambient temperature range of -25°C to 40°C. P. J. Schram of UL, who is presently on Code Panel 14, is familiar with this.

"Operation in a 40°C ambient" can only be an academic statement and not a realistic statement. In my opinion there is a need on the part of specifiers, equipment manufacturers, users, and regulating authorities for a clear statement that equipment for hazardous locations is approved based on a specified ambient temperature range.

PANEL RECOMMENDATION: Accept as Revised

"Approved equipment shall be marked to show the Class, Group, and operating temperature or temperature range referenced to a 40°C ambient.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: Joseph L. Yosafat, General Electric Co.

500-2(b): Reject

SUBMITTER: Douglas R. Pratt, Dow Corning Corp.

PROPPOSAL: 17: Add the words "and inorganic" following the word "organic" in the second paragraph.

SUBSTANTIATION: Recently we have been involved in the Classification of production facilities in which combustible elemental silicon is present in a dust form. Dust particle size ranges from 1 to 90 microns, with the bulk of samples at approximately 35 microns.

Difficulty was encountered with the application of Section 500-2, describing the various "Groups" of hazardous dust materials. In an effort to determine the particular "Group" into which elemental silicon would fall, we turned to definitions developed by the Instrument Society of America, and recently revised under the title "Class II, Division 1 and Class II, Division 2 locations."

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operating Millers, J. Healy, Grain Elevator and Processing Society

PROPPOSAL: 16: Revise the word "ignitable" to be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

SUBMITTER: BILL: It is noted that a semicolon appears between condition (1) and condition (2). This was considered an editorial change when Panel 14 made the changes on the 1975 Code. Since it is a substantive change, I believe the comma should replace the semicolon.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operating Millers, J. Healy, Grain Elevator and Processing Society

500-4(a)(1): Accept

SUBMITTER: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operating Millers, J. Healy, Grain Elevator and Processing Society

PROPPOSAL: 16: Revise the word "ignitable" to be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: C. W. 14

500-5(a)(1): Accept

SUBMITTER: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operating Millers, J. Healy, Grain Elevator and Processing Society

PROPPOSAL: 16: Revise the word "ignitable" to be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: MILLER: I am of the opinion that the exceptions should be worded to indicate that they do not apply to listed equipment.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: MILLER: I am of the opinion that the exceptions should be worded to indicate that they do not apply to listed equipment.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: MILLER: I am of the opinion that the exceptions should be worded to indicate that they do not apply to listed equipment.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: MILLER: I am of the opinion that the exceptions should be worded to indicate that they do not apply to listed equipment.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBMITTER: MILLER: I am of the opinion that the exceptions should be worded to indicate that they do not apply to listed equipment.

EXEMPT: To be consistent with the Panel Recommendation on Proposal No. 1, the word "ignitable" preceding "concentrations" should be changed to "ignitable.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
500-5(a) and (b): Accept

SUBMITTER: G. A. Karstens, American Feed Manufacturers
Association, F. Lindholm, Association of Operating Millers, J. Healy, Grain Elevator and Processing Society

PROPOSAL: 18 Delete the fine print notes in both of these paragraphs.

SUBSTANTIATION: The wording as is in the fine print notes was prepared some 25 years ago. There has been little bit of change in this wording. Since that particular time, there has been a great deal of change in the industry's operation, and the wording as is needs an extreme revision.

CUTOUTS: Accept as Revised:

Delete the FPN in Section 500-5(b). Delete first paragraph of FPN in Section 500-5(b). Add next to last sentence to read: "Electrically conductive dusts are dusts with a resistivity less than 105 ohm-cm."

VOTE ON PANEL RECOMMENDATION:

AFFIRMATIVE: 13.
NEGATIVE: Conaway, Short.
NOT VOTING: Adams.

EXPLANATION OF VOTE:

ADAMS: I am not voting on this Proposal because the proposed revision would remove Class II Division 1 locations. I would favor the original proposal more.

CONAWAY: I am voting negatively on this proposal. I could accept the elimination of the first paragraph of the FPN for 500-5(a) if the second paragraph was retained.

SHORT: There is no justification to accept 105 ohm centimeters as the cutoff point for conductive dusts. This proposal would in effect divide Group F into two groups.

500-5(b): Accept

SUBMITTER: G. A. Karstens, American Feed Manufacturers
Association, F. Lindholm, Association of Operating Millers, J. Healy, Grain Elevator and Processing Society

PROPOSAL: 19 Revise as follows:

A Class II, Division 2 location is a location in which combustible dust will normally be in suspension in the air or will not be likely to be thrown into suspension by the normal operation of equipment or apparatus in quantities sufficient to produce explosive or ignitable mixtures, but (1) there shall be spillage that may occur will be readily removed and where the accumulation of combustible dusts will not be sufficient to interfere with the normal operation of electrical equipment or apparatus; or (2) where such deposits or accumulations of combustible dusts on, in or in the vicinity of electric equipment might be ignited by arcs, sparks or burning material from the failure or abnormal operation of such equipment.

SUBSTANTIATION: The wording as changed better describes the condition that exists in present Class II, Division 2 locations.

CUTOUTS: The additional wording is needed to stress the fire hazards existing in sawmill locations, from fibers and flyings. Fibers and flyings from green timber will dehydrate and carbonize in a short period of time, and, being an organic material, is highly susceptible to spontaneous ignition. The wording "woodworking plants" does not give an indication that sawmills should be included in this class. In the industry, woodworking plants are generally considered to be those locations where wood products are finished after the original milling of the raw timber. Sawdust and woodchips that are fibers and flyings in sawmills are not mentioned in the second fine print note paragraph in Section 500-6(a). It is obvious that many types of fibers and flyings are not mentioned, but one as prevalent in many areas as sawdust and woodchips should be mentioned there.

CHANGE: Change woodworking plants to woodworking locations because woodworking locations other than woodworking plants present the same hazards as do the woodworking plants.

VOTE ON PANEL RECOMMENDATION: National. VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COMMENT ON VOTE:

SHORT: Although it is recognized that the wording here is a marked improvement over that presently in the 1978 NEC, further improvement will be achieved by the following revised wording:

A Class II, Division 2 Location is a location in which:

1. Combustible dust will not normally be in suspension in the air or in quantities sufficient to produce explosive or ignitable mixtures, but (1) there shall be spillage that may occur will be readily removed and where the accumulation of combustible dusts will not be sufficient to interfere with the normal operation of electrical equipment or apparatus; or (2) where such deposits or accumulations of combustible dusts on, in or in the vicinity of electric equipment might be ignited by arcs, sparks or burning material from the failure or abnormal operation of such equipment.

SUBSTANTIATION: The revision would remove Class II, Division 1 locations. I would favor the original proposal more.

CONAWAY: I am voting negatively on this Proposal since I feel further revision is needed. The present section lists clothing manufacturing plants. Clothing plants such as shirt factories, dress factories, suit manufacturers, etc., do not have hazards needing Class III, Division 1 installation. Clothing manufacturing facilities are and should be covered but clothing manufacturing plants should not be.

EWERS: I believe it is too restrictive to include all small woodworking operations in Class III, Division 1.

500-6(a) FPN: Reject

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 21 In the first paragraph of the fine print note, DELETE the words "woodworking plants" and replace with the words "sawmills and other woodworking locations."

In the second paragraph, add the words "sawdust, woodchips, and dust accumulations resulting therefrom may be ignitable by hot metal, such as lamps, lampholders for fixed lighting, cutouts, switches, receptacles, charging panels, generators, motors or other rotating equipment having make-or-break or sliding contacts shall be of the totally enclosed type or shall be provided with suitable guards or screens to prevent the escape of sparks or hot metal particles."

SUBSTANTIATION: This proposal is intended to correct an omission in the Code which does not generally recognize and provide for the hazard of dropping molten metal or hot metal particle into hazardous areas when overhead electrical wiring or equipment above and out of the hazardous location, develops a fault. This requirement is found in certain specific locations but it should be stated in Article 500 for all hazardous locations as the danger is the same.

VOTE ON PANEL RECOMMENDATION: Reject.

COMMENT ON VOTE:

SHORT: Supporting comment is not persuasive as to necessity.

500-7-(new): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, California.

PROPOSAL: 22 Add a new section as follows:


(a) All fixed wiring, metal raceways above hazardous locations shall be in metallic raceways. Type MI cable or ALS cable. Cellulose metal floor raceway may be used only for supplying ceiling outlets or extensions to the area below the floor, but such raceway shall have no connections leading into or through any hazardous locations above the floor.

(b) Equipment which may produce arcs, sparks or particles of hot metal, such as lamps, lampholders for fixed lighting, cutouts, switches, receptacles, charging panels, generators, motors or other rotating equipment having make-or-break or sliding contacts shall be of the totally enclosed type or shall be provided with suitable guards or screens to prevent the escape of sparks or hot metal particles.

SUBSTANTIATION: This proposal is intended to correct an omission in the Code which does not generally recognize and provide for the hazard of dropping molten metal or hot metal particle into hazardous areas when overhead electrical wiring or equipment above and out of the hazardous location, develops a fault. This requirement is found in certain specific locations but it should be stated in Article 500 for all hazardous locations as the danger is the same.
I. 25 Add "nominal" after "120 volts."

II. Division I locations, threaded rigid metal conduit, Type MI cable or ALS cable. Cellular metal floor raceway may be used only for supplying ceiling outlets or extensions to the area below the floor, but such raceway shall have no connections leading into or through any hazardous locations above the floor.

III. Equipment which may produce arcs, sparks or particles of hot metal, such as lamps, lampholders for fixed lighting, cutouts, switches, receptacles, charging panels, generators, motors or other rotating equipment having make-or-break or sliding contacts, shall be of the totally enclosed type or shall be provided with suitable guards or screens to prevent the escape of sparks or hot metal particles.

IV. This proposal is intended to correct an omission in the Code which does not generally recognize and provide for the hazard of dropping molten metal or hot metal particles into hazardous locations which are serviced by overhead electrical wiring or equipment above and out of the hazardous location, develops a fault. This requirement is found in certain specific locations but it should be stated in Article 500 for all hazardous locations as the danger is the same.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Supporting comment is not persuasive as to necessity.

VOTE ON PANEL RECOMMENDATION: UNANIMOUSLY AFFIRMATIVE.

BOSTON: See Comment on Proposal No. 22.

ARTICLE 501 -- CLASS I LOCATIONS

501-3(a): Accept


PROPOSAL: 24 Revise first sentence of second paragraph as follows:

Enclosures approved for Class I, Division 1 locations include: (a) explosion-proof enclosures, and (b) purged and pressurized enclosures.

SUBSTANTIATION: To clarify intent.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: UNANIMOUSLY AFFIRMATIVE.

501-3(b)(6)(2): Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 25 Add "nominal" after "120 volts."

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

PANEL RECOMMENDATION: Accept.

PANEL COMMENT: CMP 14 recommends that by changing Section 110-4(b) Exception No. 2: Where installed in cable tray, Type MV single conductors and multiconductor cables rated 2001 Volts and over shall have metallic shielding on each conductor.

Multiconductor Type MC cable with a continuous metallic sheath shall be permitted to have nonshielded conductors.

SUBSTANTIATION: The existing text requires the use of shielded conductors, both single and multiconductor, in cable trays for over 600 Volts. The proposal does not define a ground fault current without an external arc.

Non-shielded single conductors and multiconductor cables would arc to the tray and then be shielded. However, multiconductor cables enclosed in a smooth metallic sheath or a welded and corrugated metallic sheath as defined for Type MC cable in Section 334-22 would not conduct fault currents and contain any arc within the cable. The two sheaths specified provide a grounding path in excess of Table 250-95.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by first paragraph of same section.

VOTE ON PANEL RECOMMENDATION: UNANIMOUSLY AFFIRMATIVE.

501-4(a): Exception (New) -- Accept

SUBMITTER: P. J. Schram, Underwriters Laboratories Inc.

PROPOSAL: 29 Add a new exception as follows:

Exception: Conduct runs entering an explosion-proof enclosure for switches, circuit breakers, fuses, relays, or other apparatus which may produce sparks, arcs, or sparks need not be sealed if the current interrupting contacts are:

a. Enclosed within a chamber hermetically sealed against the entrance of gases or vapors.

b. Immersed in oil in accordance with Section 501-6(b)(1) and (2).

SUBSTANTIATION: We believe it is the intent of the first sentence of Section 501-5(a)(1) and Section 501-5(a)(2) to require seals in conduit runs 1 1/2-inch trade size and smaller only when the conduit runs enter enclosures containing a source of ignition under normal operating conditions. The Code does not require seals on conduit runs 1 1/2-inch trade size or smaller entering explosion-proof junction boxes if the boxes contain only wiring and splices. If the interruption of current occurs within a hermetically sealed chamber or the contacts are properly oil immersed, there is no ignition source under normal operating conditions, and the construction's essentially the same as an explosion-proof outlet box containing only wiring and splices.

Conductors which may be flexed as a condition of normal operation, such as mercury-tube switch leads, could eventually fail and result in arcing, but we do not believe it was the original intent of the Code to consider such leads as apparatus which may produce arcing, sparks, or high temperatures. For example, the Code does not appear to require leads in explosion-proof flexible connections which may be flexed under normal conditions to be sealed.

We believe that Section 501-5(a)(1) of the Code should be clarified so that such apparatus as mentioned above will have a clear indication as to whether or not seals are required in conduit runs entering explosion-proof enclosures housing mercurymercury-tube switcheled the contacts are properly sealed. This requirement is found in certain specific locations but it should be stated in Article 500 for all hazardous locations as the danger is the same.

PANEL RECOMMENDATION: Accept as Revised.

VOTE ON PANEL RECOMMENDATION: UNANIMOUSLY AFFIRMATIVE.

501-4(b): Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 27 In the last paragraph add "nominal" after "600 volts."

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

PANEL RECOMMENDATION: Accept.

PANEL COMMENT: See Panel Comment on Proposal 25.

VOTE ON PANEL RECOMMENDATION: UNANIMOUSLY AFFIRMATIVE.
500-7-(New): Reject

SUBMITTER: Southwestern Section IAEI


(a) All fixed wiring installed in the open space above hazardous locations shall be in metallic raceways, type MI cable or ALS cable. Cellular metal floor raceway may be used only for supplying ceiling outlets or extensions to the area below the floor, but such raceway shall not have any connections leading into or through any hazardous locations above the floor.

(b) Equipment which may produce arcs, sparks or particles of hot metal, such as lamps, lampholders for fixed lighting, cutouts, switches, receptacles, charging panels, generators, motors or other rotating equipment having make-or-break or sliding contacts, shall be of the totally enclosed type or shall be provided with suitable guards or screens to prevent the escape of sparks or hot metal particles.

SUBSTANTIATION: This proposal is intended to correct an omission in the Code which does not generally recognize and provide for the hazard of dropping molten metal or hot metal particles into hazardous areas. Vandalized underground electrical wiring or equipment above and out of the hazardous location, develops a fault. This requirement is found in certain specific locations but it should be stated in Article 500 for all hazardous locations as the danger is the same.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: No evidence to support the suggested change.

VOTE ON PANEL RECOMMENDATION:

UNANIMOUSLY AFFIRMATIVE.

501-3(a)(2) Reject

SUBMITTER: P. J. Schram, Underwriters Laboratories Inc.

PROPOSAL: 28 Delete last paragraph of 501-4(b).

No. 2(b) Exception No. 2-(New): Reject

SUBMITTER: Robert G. Machan, Panacuff, RI

PROPOSAL: 30 Add a new (5) as follows:

(5) Number of Conductors Allowed in One Seal. The number of conductors allowed in any one seal shall be limited to nine. Submittals must be tested according to established methods. Proposed additions will have a clear indication as to whether or not seals are required in conduit runs entering explosion-proof junction boxes if the boxes contain only wiring and splices. If the interruption of current occurs within an electrically sealed chamber or the contacts are properly oil immersed, there is no ignition source under normal operating conditions, and the construction is essentially the same as an explosion-proof outlet box containing only wiring and splices.

PANEL RECOMMENDATION: Accept as Revised.

PANEL COMMENT: Between the words "runs" and "entering" add the words "1 1/2 inches and smaller.

VOTE ON PANEL RECOMMENDATION:

UNANIMOUSLY AFFIRMATIVE.
I believe it should be left out. The gas passing through the fitting, shall not be affected by the surrounding atmosphere or liquids, and shall not have a melting point of less than 93°C (200°F).

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Supporting comment is not persuasive as to necessity.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.


EXPLANATION OF VOTE:

UNIVERSITY: I am voting affirmatively, I believe the Panel Recommendation makes the design too necessary. A more general statement of desired performance would be preferable.

PANEL RECOMMENDATION: Accept as Revised:

PANEL COMMENT: Already covered by Section 500-2(a) and (c).

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Panel: 14. CMP 14

SUBMITTER: W.A. Short, Crouse-Hinds Company

PROPOSAL: See the Technical Subcommittee “Recommendations” under the definition of “Approved for the Purpose” in Article 100.

SUBSTANTIATION: See the TSC “findings” under the definition of “Approved for the Purpose” in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Panel: 14. CMP 14

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: Add a third paragraph as follows:

A comparison between the UL required Jacket thickness for motor operating temperature consistent with past practice, or rotating electric machinery not approved for Class I, Division 2 locations to the combination of vapor ignition temperature and gas or vapor ignition temperature prevalent some years ago; under the conditions then existing, experience has proven that the present wording of this section of the Code provided safe installations. However, the ignition temperature of some of the newer gases is approaching the operating temperature of some higher temperature capability motors. Under these more recent conditions, safety hazards may exist when applying non-explosion-proof motors per the present wording of the Code.

The proposed change, then, limits use of open or non-explosion-proof enclosed motors in Class I, Division 2 locations to the combination of vapor ignition temperature and motor operating temperature consistent with past practice, or provides a safe system by limiting motor temperatures to 80 percent of the gas or vapor ignition temperature.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by Section 500-2(a) and (c).

VOTE ON PANEL RECOMMENDATION: Affirmative: 16.

NEGATIVE: Short.

EXPLANATION OF VOTE:

UNIVERSITY: The referenced 500-2(a) and (c) are effective for listed or certified equipment, but will in no way prevent the application of standard and/or stock squirrelcage motors in Class II, Division 2 areas. Only a specific limitation in 501-8(b) can be effective in minimizing this potential hazard.

Panel: 14. CMP 14

SUBMITTER: C.E. Muhleman, Marion, IN

PROPOSAL: 32. Revise as follows:

"Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Panel: 15. CMP 15

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 35A Revise 501-8(b) Motors and Generators, Class I, Division 2. Add a third paragraph as follows:

In Class I, Division 2 locations, motors, generators and other rotating electric machinery not approved for Class I, Division 2 locations shall be permitted only if:

1. Ignition temperature of the gas or vapor involved is 280°C (536°F) or higher, and

2. Nameplate is marked not over 80°C temperature rise (85°C for totally enclosed nonventilated construction) by resistance at 100% load or 90°C temperature rise by resistance at Service Factor load, or

3. Nameplate is marked to indicate Class A or Class B Insulation System and Maximum Ambient Temperature.

Exception: Motors and generators with Class F or Class H Insulation System or in installations involving gases or vapors having ignition temperatures below 280°C (536°F) shall be permitted if the maximum rated load operating temperature of any exposed surface (including internal parts of all constructions) will not exceed 80 percent of the ignition temperature in degrees Celsiur of the gas or vapor involved.

SUBSTANTIATION: The present wording of 501-8(b) was based on relation of exposed motor surface temperatures and gas or vapor ignition temperatures prevalent some years ago; under the conditions then existing, experience has proven that the present wording of this section of the Code provided safe installations. However, the ignition temperature of some of the newer gases is approaching the operating temperature of some higher temperature capability motors. Under these more recent conditions, safety hazards may exist when applying non-explosion-proof motors per the present wording of the Code.

The proposed change, then, limits use of open or non-explosion-proof enclosed motors in Class I, Division 2 locations to the combination of vapor ignition temperature and motor operating temperature consistent with past practice, or provides a safe system by limiting motor temperatures to 80 percent of the gas or vapor ignition temperature.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Already covered by Section 500-2(a) and (c).

VOTE ON PANEL RECOMMENDATION: Affirmative: 16.

NEGATIVE: Short.

EXPLANATION OF VOTE:

UNIVERSITY: The referenced 500-2(a) and (c) are effective for listed or certified equipment, but will in no way prevent the application of standard and/or stock squirrelcage motors in Class II, Division 2 areas. Only a specific limitation in 501-8(b) can be effective in minimizing this potential hazard.
Paragraph 1: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 36 See the Technical Subcommittee "Recommendations"
Under the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
In line 8 delete "for the purpose and." 
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 2: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 37 See the Technical Subcommittee "Recommendations"
Under the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
In line 6 insert "an approved" before "fitting" and delete "approved for the purpose.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 3: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 39 See the Technical Subcommittee "Recommendations"
Under the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Leave paragraph 16 and renumber (5) and (6) to (4) and (5).
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 4: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 40 In the first sentence, delete the words "in degrees Celsius" and the words "likely to be" and replace with the words "which is.
Panel Recommendation: Accept As Revised.
Panel Comment: The use of the word "likely" renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 5: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 41 Add new exception as follows:
Second Exception: Electric submersible wastewater pumps with means for automatic removal without entering or dewatering the wet-pit shall be considered portable utilization equipment. In Class 1, Div. 1 locations, the pumps (unless approved for the location) shall remain completely submerged under all operating conditions with the liquid level at least four inches above any portion of the pump-excepting the cable. See Section 501-13 for flexible cords exposed to liquids having a deleterious effect on the conductor insulation.
Panel Recommendation: Accept As Revised.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 6: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 42 Revise the last sentence as follows:
"Electric submersible pumps with means for removal without entering the wet-pit shall be considered portable utilization equipment." 
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 7: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 43 See the Technical Subcommittee "Recommendations" in the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 8: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 44 See the Technical Subcommittee "Recommendations" in the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 9: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 45 See the Technical Subcommittee "Recommendations" in the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 10: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 46 See the Technical Subcommittee "Recommendations" in the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 11: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 47 See the Technical Subcommittee "Recommendations" in the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

Paragraph 12: The definition of "Approved for the Purpose" in Article I
Subpart: Accept
Proposal: 48 See the Technical Subcommittee "Recommendations" in the definition of "Approved for the Purpose" in Article 100.
Panel Recommendation: Accept As Revised.
Panel Comment: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
SUBMITTER: Robert B. West, St. Louis, MO

PROPOSAL: 44 Revise as follows:

Article 250-23 shall require a grounded service conductor to be 20% larger than the ungrounded service conductor to which it is connected.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PANEL RECOMMENDATION: Accept as Revised:

(a) Ground-fault protection shall be provided for each solidly grounded branch circuit where conductors are not protected against overcurrent in accordance with their ampacities (see Section 240-3) exists for a good purpose, but it is not sufficient to protect against fault currents in Class I locations. The higher the fault current, the greater the possibility of extensive damage before the circuit is opened by the fault current. This proposal correlates with my proposal to revise Section 501-16(f).

(b) The grounded service conductor shall be connected to a grounding electrode at the transformer supplying the service. A grounding conductor shall be run with the service conductors from the service equipment to the grounding electrode, and shall be sized in accordance with the requirements for grounding the grounded service conductor in Section 250-23(b). The grounded service conductor shall be bonded to the grounded service conductor at the transformer supplying the service and to the equipment grounding conductor(s) at the service equipment.

SUBSTANTIATION: Objectional currents from flowing to ground the grounded service conductor at the supply transformer only, provided the conditions stated in (2) and (3) of the proposed revision are met. These conditions assure an adequate conductor for ground-fault current to flow from the service equipment to the supply transformer, and the potential between service equipment enclosures and ground will not be unsafe during ground-fault conditions. The surges are then the potential between the service equipment and the ground, which is dangerous in areas of high lightning activity.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

501-17-(New): Reject

SUBMITTER: Kenneth L. Paspe, Allen Bradley Co.

PROPOSAL: 47 Amend the proposed correction as follows:

Section 250-23(c) Ground-fault protection shall be provided for each solidly grounded branch circuit where conductors are not protected against overcurrent in accordance with their ampacities (see Section 240-3) exists for a good purpose, but it is not sufficient to protect against fault currents in Class I locations. The higher the fault current, the greater the possibility of extensive damage before the circuit is opened by the fault current. This proposal correlates with my proposal to revise Section 501-16(f).

(b) The grounded service conductor shall be connected to a grounding electrode at the transformer supplying the service. A grounding conductor shall be run with the service conductors from the service equipment to the grounding electrode, and shall be sized in accordance with the requirements for grounding the grounded service conductor in Section 250-23(b). The grounded service conductor shall be bonded to the grounded service conductor at the transformer supplying the service and to the equipment grounding conductor(s) at the service equipment.

SUBSTANTIATION: Objectional currents from flowing to ground the grounded service conductor at the supply transformer only, provided the conditions stated in (2) and (3) of the proposed revision are met. These conditions assure an adequate conductor for ground-fault current to flow from the service equipment to the supply transformer, and the potential between service equipment enclosures and ground will not be unsafe during ground-fault conditions. The surges are then the potential between the service equipment and the ground, which is dangerous in areas of high lightning activity.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

501-16(c): Accept

SUBMITTER: Robert B. West, St. Louis, MO

PROPOSAL: 43 Revise as follows:

Each ungrounded service conductor of a wiring system in a Class I area, where supplied from an overhead line in an area where lightning disturbances are prevalent, shall be protected by a surge arrester that complies with the provisions of Article 280.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

PANEL RECOMMENDATION: Accept as Revised:

(a) The grounded service conductor shall be connected to a grounding electrode at the transformer supplying the service. A grounding conductor shall be run with the service conductors from the service equipment to the grounding electrode, and shall be sized in accordance with the requirements for grounding the grounded service conductor in Section 250-23(b). The grounded service conductor shall be bonded to the grounded service conductor at the transformer supplying the service and to the equipment grounding conductor(s) at the service equipment.

(b) The service equipment grounding conductor specified in (2) above, and the equipment grounding conductor(s) shall be bonded together and connected to a grounding electrode by a grounded service conductor with the provisions of Article 280.

SUBSTANTIATION: A CMP 5 Subcommittee has submitted proposals to update Article 280 to current nomenclature and practices. Article 280 covers the selection, installation, and connection of surge arresters. The proposed revision has references to Article 280 which amends the selection, installation, and connection of surge arresters in Class I locations consistent with the updated provisions in Article 280.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

501-16(d): Accept

SUBMITTER: Robert B. West, St. Louis, MO

PROPOSAL: 44 Revise as follows:

Grounded Service Conductor, Connections to Service Equipment. Where a Class I location is supplied from an alternating-current system, all grounded service conductors are caused by multiple grounding connections to the service equipment. The higher the fault current, the greater the possibility of extensive damage before the circuit is opened by the fault current. This proposal correlates with my proposal to revise Section 501-16(f).

The grounded service conductor shall be connected to a grounding electrode at the transformer supplying the service. A grounding conductor shall be run with the service conductors from the service equipment to the grounding electrode, and shall be sized in accordance with the requirements for grounding the grounded service conductor in Section 250-23(b). The grounded service conductor shall be bonded to the grounded service conductor at the transformer supplying the service and to the equipment grounding conductor(s) at the service equipment.

SUBSTANTIATION: Objectional currents from flowing to ground the grounded service conductor at the supply transformer only, provided the conditions stated in (2) and (3) of the proposed revision are met. These conditions assure an adequate conductor for ground-fault current to flow from the service equipment to the supply transformer, and the potential between service equipment enclosures and ground will not be unsafe during ground-fault conditions. The surges are then the potential between the service equipment and the ground, which is dangerous in areas of high lightning activity.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

501-16(e): Accept

SUBMITTER: Robert B. West, St. Louis, MO

PROPOSAL: 44 Revise as follows:

The title of this Section will be: "Multiple Grounds." In the proposal to revise the text of Section 501-16(f) covers conditions when a grounded service conductor is grounded at the service equipment if the service drop is grounded at a point other than the service equipment. This proposal correlates with my proposal to revise Section 501-16(f).

Exception: Where the installation complies with all of the conditions specified in Sections 250-23(a), 250-50(a), and 250-53, the grounded service conductor shall not be required to be run to the service equipment.

SUBSTANTIATION: This proposed revision correlates with my proposal to revise the text of Section 501-16(f). The proposed revision of the referenced sections complete specifications for the general requirements in Sections 250-71, 250-72, 250-73, 250-74, 250-75, 250-76, 250-77, 250-78, and 250-79 cover bonding requirements for the noncurrent-carrying metal parts of equipment, raceways and other enclosures on the supply side and on the load side of the service equipment.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
Panel Recommendation: Reject.  
Panel Comment: The supporting comment does not justify the proposed change.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

### ARTICLE 502 - CLASS II LOCATIONS

#### 502-1:  
Submitter: G. A. Karstens, American Feed Manufacturers  
Association, F. Lindholm, Association of Operative Mills, J. Healy, Grain Elevator and Processing Society  
Proposal: 48 After the third paragraph add a paragraph as follows:  
For further information see NFPA 496 Purged and Pressurized Enclosures for Electrical Equipment - 1974.  
Substantiation: Material in this bulletin will aid materially in describing the proper requirements for motor control centers for Class II locations.  
Panel Recommendation: Reject.  
Panel Comment: Already covered by Section 502-1.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

#### 502-2:  
Submitter: Robert B. West, St. Louis, MO  
Proposal: 51 Revise second sentence to read: “Cable tray shall not be permitted in Class II, Division 1 or 2 locations.”  
Substantiation: Cable trays are dust collectors and should not be used in Class II areas.  
Panel Recommendation: Accept as Revised.  
Panel Comment: Tray should read “trays.”  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

### 502-3:  
Submitter: J. F. Lindholm, Association of Operative Mills, J. Healy, Grain Elevator and Processing Society  
Proposal: 53 Revise as follows:  
“Where a raceway provides communication between an enclosure that is required to be dust ignition proof and an enclosure in an unclassified location, seals will not be required.”  
Substantiation:电缆 trays are dust collectors and should not be used in Class II areas.  
Panel Recommendation: Accept.  
Panel Comment: The Panel does not agree with the supporting comment.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

#### 502-4(a):  
Proposal: 52 Revise first sentence of (a) as follows:  
“In Class II, Division 1 locations, threaded rigid metal conduit (TM), rigid metal conduit (RMC), rigid flexible metal conduit (RLC), or Type MC cable employing a continuous smooth or corrugated aluminum sheath with termination fittings approved for the location shall be the wiring method employed.”  
Substantiation: Type MC cable employing a continuous smooth or corrugated aluminum sheath has a tight fitting core and is sheathed in an impervious aluminum tube that has superior crush and impact resistance.  
Panel Recommendation: Reject.  
Panel Comment: There were some problems with the formulation of the proposed change.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

### 502-5:  
Submitter: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operative Mills, J. Healy, Grain Elevator and Processing Society  
Proposal: 54 Delete Section 502-4.  
Substantiation: Section 502-4 has been deleted in the proposed change.  
Panel Recommendation: Accept.  
Panel Comment: The Panel Recommendation is not clear. My notes indicate it was to add the quoted paragraph to Section 502-5.  
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
ARTICLE 502 -- CLASS II LOCATIONS

502-1: Reject

SUBMITTER: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operative Millers, J. Healy, Grain Elevator and Processing Society

PROPOSAL: 48 After the third paragraph add a paragraph as follows:

For further information see NFPA 496 Purged and Pressurized Enclosures for Electrical Equipment - 1974.

SUBSTANTIATION: Material in this bulletin will aid materially in describing the proper requirements for motor control centers for Class II, Division 1 locations.

VOTE ON PANEL RECOMMENDATION: Reject.

502-1: Accept

SECRETARY'S NOTE: It was the action of the Correlating Committee that the panel shall review their recommendation with a view towards correcting grammatical errors.

SUBMITTER: W. A. Short, Crouse-Hinds Company

PROPOSAL: 49 Add a new sentence to the end of 502-1:

These cable types are permitted in Class I, Division 1 locations and it is consistent to also permit their use in Class II, Division 1 locations where Class II, Groups E and F dusts are present. See Section 500-5(a).

SUBSTANTIATION: The information in 502-5(a) is not well understood in the industry. This wording does not change the intent, but helps to clarify the information already in the Code.

VOTE ON PANEL RECOMMENDATION: Accept as Revised.

502-2(b)(3)(2): Accept

SUBMITTER: TSC-Nominal Voltage

PROPOSAL: 50 Add "nominal" after "600 volts."

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

VOTE ON PANEL RECOMMENDATION: Accept.

502-3: Accept

SUBMITTER: Robert B. West, St. Louis, MO

PROPOSAL: 53 Revise as follows:

502-3. Surge Protection. Class II, Divisions 1 and 2. In geographical locations where lightning disturbances are prevalent, where circuits are supplied by overhead services, electrical systems in Class II locations shall be protected against high-voltage surges. This protection shall include surge arresters, interconnection of all grounds, and surge-protective capacitors. Surge arresters, including their installation and connections, shall comply with Article 280. Surge protective arresters shall be of a type designed for the specific duty. The capacitor grounding conductors shall be connected to the grounding conductors for the surge arresters. Surge protective capacitors shall be connected to each ungrounded service conductor at the service entrance or service equipment. The capacitors shall be protected by 30-ampere fuses of suitable type and voltage rating, or by automatic circuit breakers of suitable type and rating. Where fuse protection is provided, a disconnecting means shall be installed to disconnect the fuses from the ungrounded service conductors.

SUBSTANTIATION: The proposed revision uses the term "surge arresters" and references Article 280 which covers the selection, installation, and connection of surge arresters. A CMP 5 Subcommittee has submitted proposals to update Article 280 to current nomenclature and practices. The grounding connections for surge arresters are adequately covered in Article 280 so it is unnecessary to cover the grounding interconnections again in Section 502-3.

The third paragraph in the present text of Section 502-3 is not enforceable.

The present text requires circuit protection devices for surge-protective capacitors. If fuses are used, a means should be provided to disconnect the fuses and capacitors. It is recommended that CMP 14 review the requirement that fuses be nominally 30 amperes while circuit breakers have no specified current rating.

VOTE ON PANEL RECOMMENDATION: Accept.

502-4: Accept

SUBMITTER: CMP 14

PROPOSAL: 51 Revise second sentence to read: "Cable tray shall not be permitted in Class II, Division 1 or 2 locations."

SUBSTANTIATION: Cable trays are dust collectors and should not be used in Class II areas.

VOTE ON PANEL RECOMMENDATION: Accept as Revised.

502-4(a): Reject


PROPOSAL: 52 Revise first sentence of (a) as follows:

In Class II, Division 1 locations, threaded rigid metal conduit, threaded rigid steel conduit, Type MI, or Type MC cable employing a continuous smooth or corrugated aluminum sheath with termination fittings approved for the location shall be the written method employed.

SUBSTANTIATION: Type MC cable employing a continuous smooth or corrugated aluminum sheath has a tight fitting core and is sheathed in an impervious aluminum tube that has superior crush and impact resistance. It has been used widely in Class II, Division 2 and Class II, Division 2 locations by the petroleum, petrochemical, coal and grain industries. Present continuous welding methods make it possible to maintain the accurate OD of the cable sheath within the UL Standard 866 for maximum diametric clearance for cylindrical joints. In earlier manufacturing processes this was not possible; therefore, the termination fitting manufacturers could not properly design a termination fitting with proper barrel length and clearance to comply with the UL Standards.

Termination fitting manufacturers, including Crouse-Hinds, have assured us that if the sheath OD can be held constant, a termination fitting designed to comply with UL Standards.

The acceptance of Type MC cable employing a smooth or corrugated aluminum sheath for use in Class II, Division 1 locations will provide an alternate wiring system that is safe and economical to install. The sheath provides a completely impervious tube from connection to connection and with approved termination fittings will eliminate the possibility of dust entering the system through joints and couplings.

We are submitting the following UL Test Reports relative to the physical properties of continuous aluminum sheathed Type MC cable including impact, crushing, flexing and dielectric withstand:

"Reports have been supplied to CMP chairman.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

502-4(b): Reject

SUBMITTER: CMP 14

PROPOSAL: 56 Add "nominal" after "600 volts."

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

VOTE ON PANEL RECOMMENDATION: Accept.

502-5: Accept

SECRETARY'S NOTE: It was the action of the Correlating Committee that further consideration be given to the comments expressed in Mr. Schram's voting.

SUBMITTER: G. A. Karstens, American Feed Manufacturers Association, F. Lindholm, Association of Operative Millers, J. Healy, Grain Elevator and Processing Society

PROPOSAL: 54 Delete Section 502-5.

SUBSTANTIATION: In Class II, Division 1 locations it is necessary that motors be adequately sealed in the terminal box and equipment is designed to be dust-tight. In Class II, Division 2 locations dust is minimally isolated in suspension. It is my understanding that there have been some problems with vertical or horizontal runs that may be just short of the required length. Dust cannot travel within the conduit and does not offer a serious problem.

VOTE ON PANEL RECOMMENDATION: Accept as Revised.

502-5: Accept

SECRETARY'S NOTE: It was the action of the Correlating Committee that further consideration be given to the comments expressed in Mr. Schram's voting.

SUBMITTER: Healy, Grain Elevator and Processing Society

PROPOSAL: 54 Delete Section 502-5.

SUBSTANTIATION: In Class II, Division 1 locations it is necessary that motors be adequately sealed in the terminal box and equipment is designed to be dust-tight. In Class II, Division 2 locations dust is minimally isolated in suspension. It is my understanding that there have been some problems with vertical or horizontal runs that may be just short of the required length. Dust cannot travel within the conduit and does not offer a serious problem.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

502-6: Accept

SECRETARY'S NOTE: It was the action of the Correlating Committee that further consideration be given to the comments expressed in Mr. Schram's voting.

SUBMITTER: American Feed Manufacturers Association, F. Lindholm, Association of Operative Millers, J. Healy, Grain Elevator and Processing Society

PROPOSAL: 55 Add "nominal" after "600 volts."

SUBSTANTIATION: To conform to the guidelines established by the TSC on Nominal Voltages.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
PROPOSAL: 55 Revise (b) as follows:

In Class II, Division 2 locations, enclosures for fuses, switches, circuit breakers, and motor controllers, including pushbuttons and relays and similar devices shall be so designed that: (1) there are no knockout holes provided in the enclosure, (2) be constructed of substantial sheet metal with continuous welds, (3) be provided with a closed cell expanded cellular rubber gasket of the oil/flame resistant type, (4) where dust-tight mechanisms are involved they shall be mounted through flexible conduit that are gasketed with a closed cell expanded cellular rubber gasket of the oil/flame resistant type, (5) doors shall be similarly gasketed, and when hinged shall be hinged for horizontal opening and be supplied with an internal fastener that requires a tool to open, (6) provisions shall be made for external mounting.

SUBSTANTIATION: The above wording provides a much clearer understanding of the intent of the enclosures for fuses, switches, circuit breakers and motor controllers including pushbuttons and relays and similar devices to be used in Class II, Division 2 locations than that used in 502-6(a)(2) in the present Code.

PANEL RECOMMENDATION: Accept as revised:

In the third line substitute the word "dust tight" for the balance of the paragraph after the words "shall be.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

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PROPOSAL: 56 Delete the reference "Section 502-6(a)(2)" and replace with "Section 502-6(b)."

SUBSTANTIATION: The above wording provides a much clearer understanding of the intent of the enclosures for fuses, switches, circuit breakers and motor controllers including pushbuttons and relays and similar devices to be used in Class II, Division 2 locations than that used in 502-6(a)(2) in the present Code.

PANEL RECOMMENDATION: Accept as revised:

In line 7 add "an approved" before "fitting" and delete "for the purpose of".

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

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PROPOSAL: 57 Revise (b) as follows:

Class II, Division 2. In Class II, Division 2 locations, motors, generators and other rotating electrical equipment shall be totally enclosed ventilated, or totally enclosed fan cooled for which maximum full load external surface temperature shall not exceed 120°C (248°F) when operating in free air (not dust blanketed). A "Class II, Division 2 location" with the wording of Sect. 502-8(b) as is would be a labeled motor. It is our contention that labeled motors are not required for use in Class II, Division 2 atmospheres, and the above wording is intended to note such. In addition, experience of the industry over many years denotes that the TEC motor has operated in Class II, Division 2 locations with good experience.

PANEL RECOMMENDATION: Accept as Revised:

"Class II, Division 2. In Class II, Division 2 locations, motors, generators and other rotating electrical equipment shall be totally enclosed ventilated, or totally enclosed fan cooled for which maximum full load external surface temperature shall not exceed 120°C (248°F) when operating in free air (not dust blanketed) and shall have no external openings. Change Exception (b) to read: ...within dust-tight metal housings..."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

COMMENT ON VOTE:

ADAMS: My notes have the Exception to read: ..."within dust-tight housings."

SHARP: The wording here is a marked improvement over that presently in 502-4, and a very worthwhile improvement, will be achieved by the following revisions:

(1) Add the following sentence after the words "...and shall have no external openings...": "Normally arcing or sparking parts shall be enclosed in tight metal housings."

(2) In Exception (b) the present 1978 NEC wording "tight metal housings" should be retained instead of changing to "dust-tight housings."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.
502-16(c): Accept
SUBMITTER: Robert B. West, St. Louis, MO
PROPOSAL: 65 Delete Section 502-16(c)
SUBSTANTIATION: This section is unnecessary because lightning protection in Class II locations is adequately covered in Section 502-3.

PANEL RECOMMENDATION: Accept
NOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

502-16(d): Accept
SUBMITTER: Robert B. West, St. Louis, MO
PROPOSAL: 66 Change (d) to (c) in the proposed revision
(d) Grounded Service Conductor, Connections at Service Equipment. Where a Class II location is supplied from an alternating-current system, the grounded service conductor shall be run to each service according to the requirements in Section 250-23(b) and shall be bonded at the service equipment if the system grounding requirement is likely to cause objectional currents from flowing, provided the conditions stated in (2) and (3) of the proposed revision are met. These conditions assure an adequate conductor for ground-fault current to flow from the service equipment to the transformer supplying the service. The Surge protection that is specified in Section 502-23 provides additional protection in Class I, Division 1, and 2 hazardous locations.

PANEL RECOMMENDATION: Accept as Revised:
NOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

502-16(e): Accept
SUBMITTER: Robert B. West, St. Louis, MO
PROPOSAL: 67 Delete Section 502-16(e)
SUBSTANTIATION: The grounded service conductor of a grounded system is required to be run to each service by the provisions of Section 250-23(b), so the condition stated in Section 502-16(e) is not permitted. Article 250 also contains adequate provisions for grounding and bonding that apply to Class II locations. For example, Section 250-23(a) requires the grounded service conductor to be grounded at service equipment, Sections 250-50(a), 250-50(b), 250-53(a), and 250-53(b) cover bonding and interconnections between the equipment grounding conductor, the grounded service conductor, the grounding electrode conductor, and the service equipment enclosures. Sections 250-71, 250-72, 250-75, 250-76, 250-77, 250-78, and 250-79 cover bonding requirements for the noncurrent-carrying metal enclosures, equipment, raceways, and other enclosures on the supply side and on the load side of the service equipment.

My proposed revision of Section 502-16(f) covers conditions which must be complied with where a grounded service conductor of a grounded system is not run to the service equipment.

PANEL RECOMMENDATION: Accept
NOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

502-16(f): Accept
SUBMITTER: Robert B. West, St. Louis, MO
PROPOSAL: 68 Revise the text of (f) as follows:
Where, in the application of Section 250-21, it is necessary to abandon the grounding and bonding connections to the grounded service conductor that are specified in (d) above, the installation shall comply with all of the following conditions:
(1) The grounded service conductor shall be connected to a grounding electrode at the transformer supplying the service.
(2) A ground-fault protective device has a rating or setting not exceeding 10 amperes. Any time-delay in the operation of the ground-fault protective device shall be 50 volts to ground, but exceeding 600 volts phase-to-phase in a Class I, Division 1 or 2 location. The ground-fault protection shall operate to open all grounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 10 amperes. Any time-delay in the operation of the ground-fault protective device shall be limited to 100 milliseconds such that the interrupting rating of the branch-circuit disconnecting or controlling means and the rating or setting of the device that provides overcurrent protection for the branch circuit meets the requirements of Section 240-3(b) and (c).

PANEL RECOMMENDATION: Unanimously Affirmative.
VOTE PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 503 -- CLASS III LOCATIONS

503-9(c): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 70 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

In line 6 insert "an approved" before "fitting delete "approved for the purpose."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

503-9(d): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 71 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

Delete paragraph and change (e) to (d).

PANEL COMMENT: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

503-17 (New): Reject

SUBMITTER: Kenneth L. Paape, Allen Bradley Co.

PROPOSAL: 72 Add new section as follows:

503-17: Ground-Fault Protection of Equipment, Class III, Divisions 1 and 2.

(a) Ground-fault protection shall be provided for each solidly grounded branch circuit where conductors are not protected against overcurrent in accordance with the ampacities and the circuit is rated more than 50 volts to ground, but exceeding 600 volts phase-to-phase in a Class III, Division 1 or 2 location. The ground-fault protection shall operate to open all ungrounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 10 amperes. Any time-delay in the operation of the ground-fault protection shall be coordinated with the interrupting rating of the branch-circuit disconnecting or controlling means and the rating or setting of the device that provides overcurrent protection for the branch circuit.

Exception No. 1: Where the circuit overcurrent protective device has a rating or setting not exceeding 100 amperes.

Exception No. 2: Where an orderly shutdown is required.

See Section 240-12.

503-17 (New):

(b) The ground-fault protection system installed shall meet the performance requirements of Section 230-95 (b) and (c).

SUBSTANTIATION: It has long been recognized in the electrical industry that arcing ground faults occur which damage equipment extensively because the ground fault current is limited by the impedance of rigid conduit or is not sustained for a sufficient period of time to cause the overcurrent protective device to clear the fault. As a consequence, damage such as shown in the attached photograph can occur with the emission of sparks and molten metal. Such emission can ignite fibers or flyers which may be present in Class III Hazardous Locations. The higher the rating or setting of the overcurrent protective device the greater the probability of extensive damage before the overcurrent protective device responds to the ground-fault current.

Each of the exceptions to the general rule of protecting conductors against overcurrent in accordance with their ampacities (see Section 240-3) exists for a good purpose, but involves some degree of risk. Motor branch circuits are particularly vulnerable because motor driven equipment often includes a source of vibration which in turn can cause insulation to abrade in conduit with the results as shown in the photograph. Providing ground-fault protection for equipment in such situations will reduce the risk inherent in circuits where conductors are not protected in accordance with their ampacities.

Similar proposals have been submitted for Class I and Class II hazardous locations.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 511 -- COMMERCIAL GARAGES, REPAIR AND STORAGE

511-2(f): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 73 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

In line 7 insert "suitable" between "other" and "material" delete "approved for the purpose."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 513 -- AIRCRAFT HANGARS

513-5(c): Accept

SUBMITTER: O. E. Dillon, Border County Div. IAETF

PROPOSAL: Delete the words "that are or may be." 

SUBSTANTIATION: the use of the word "may" renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Accept as Revised:

"Portable lamps that are used within a hangar shall be approved for the location in which they are used."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

513-8: Reject

SUBMITTER: O. E. Dillon, Border County Div. IAETF

PROPOSAL: 75 Delete 513-8.

SUBSTANTIATION: This section is practically unenforceable unless the jurisdiction has the man-power to make routine inspection of aircraft in aircraft hangars. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

513-9: Reject

SUBMITTER: O. E. Dillon, Border County Div. IAETF

PROPOSAL: 76 Delete 513-9.

SUBSTANTIATION: This section is practically unenforceable unless the jurisdiction has the man-power to make routine inspection of aircraft in aircraft hangars. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 514 -- GASOLINE DISPENSING AND SERVICE STATIONS

514-2: Accept

SUBMITTER: Edward C. Sommer NFPA No. 30 S/C General Storage Plan & Comb. Liquids

PROPOSAL: 77 Delete Section 514-2(a) through (g) and replace with the following:

The following table shall be applied where Class I liquids are stored, handled or dispensed and shall be used to delineate and classify service station areas for the purpose of electrical equipment under normal circumstances. It is based on the premise that the installation meets all requirements of NFPA No. 30. Should this not be the case, the inspector shall have the authority to determine the extent of the classified area.

A classified area shall not extend beyond an unperked wall, roof or other solid partition.

SUBSTANTIATION: NFPA No. 30 S/C General Storage and Handling of Flammable and Combustible Liquids has the basic responsibility for classification of electrical areas in service stations. The present text in No. 70 is not in complete agreement with No. 30 and thus presents a conflict. This can be eliminated by:

1. Revision of the existing text in No. 70, or
2. By dropping requirements contained in these articles and referencing No. 30, or
3. By incorporating the table contained in No. 30 into 514-2 of No. 70.

One of the three approaches, number 3 is probably the most attractive since it eliminates the conflict and provides information to the inspector without the need for an additional reference code. Updating as changes may be made in No. 30 is not a significant problem since both codes are close in cycles.
I In line 6 insert "an approved" before "fitting delete "approved for the purpose." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

503-9(c): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 70 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

In line 6 insert "an approved" before "fitting delete "approved for the purpose." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

503-9(d): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 71 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

Delete paragraph and change (e) to (d).

PANEL COMMENT: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.

PANEL RECOMMENDATION: Unanimously Affirmative.

503-17-(New): Reject

SUBMITTER: Kenneth L. Paape, Allen Bradley Co.

PROPOSAL: 72 Add new section as follows:

503-17: Ground-Fault Protection of Equipment, Class III, Divisions 1 and 2.

(a) Ground-fault protection shall be provided for each solidly grounded branch circuit where conductors are not protected against overcurrent in accordance with their ampacities and the circuit is rated more than 50 volts to ground, but exceeding 600 volts phase-to-phase in a Class III, Division 1 or 2 location. The ground-fault protection shall operate to open all ungrounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 10 amperes. Any time-delay in the operation of the ground-fault protection shall be coordinated with the interrupting rating of the branch-circuit disconnecting or controlling means and the rating or setting of the device that provides overcurrent protection for the branch circuit.

Exception No. 1: Where the circuit overcurrent protective device has a rating or setting not exceeding 100 amperes.

Exception No. 2: Where an orderly shutdown is required.

(See Section 240-12).

503-17-(New): Ground-fault protection system installed shall meet the performance requirements of Section 230-95 (b) and (c).

SUBSTANTIATION: It has long been recognized in the electrical industry that arcing ground faults occur which damage equipment extensively because the ground fault current is limited by the impedance of rigid conduit or is not sustained for a sufficient period of time to cause the overcurrent protective device to clear the fault. As a consequence, damage such as shown in the attached photograph can occur with the emission of sparks and molten metal. Such emission can ignite fibers or flyers which may be present in Class II Hazardous Locations. The higher the rating or setting of the overcurrent protective device the greater the probability of extensive damage before the overcurrent protective device responds to the ground-fault current.

Each of the exceptions to the general rule of protecting conductors against overcurrent in accordance with their ampacities (See Section 240-3) exists for a good purpose, but involves some degree of risk. Motor branch circuits are particularly vulnerable because motor driven equipment often includes a source of vibration which in turn can cause incrustation to abrade in conduit with the result shown in the photograph. Providing ground-fault protection for equipment in such situations will reduce the risk inherent in circuits where conductors are not protected in accordance with their ampacities.

Similar proposal and change submitted for Class I and Class II hazardous locations.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 511 -- COMMERCIAL GARAGES, REPAIR AND STORAGE

511-2(f): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 73 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

In line 7 insert "suitable" between "other" and "material" delete "approved for the purpose." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 513 -- AIRCRAFT HANGARS

513-5(c): Accept

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 74 Delete the words "that are or may be." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

SUBSTANTIATION: The use of the word "may" renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Accept as Revised:

"Portable lamps that are used within a hangar shall be approved for the location in which they are used." VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

513-8: Reject

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 75 Delete 513-8.

SUBSTANTIATION: This section is practically unenforceable unless the jurisdiction has the man-power to make routine inspection of aircraft in aircraft hangars. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

513-9: Reject

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: 76 Delete 513-9.

SUBSTANTIATION: This section is practically unenforceable unless the jurisdiction has the man-power to make routine inspection of aircraft in aircraft hangars. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-2: Accept

SUBMITTER: Edward C. Sommer NFPA No. 30 S/C General Storage Plan & Comb. Liquids

PROPOSAL: 77 Delete Section 514-2(a) through (g) and replace with the following:

The following table shall be applied where Class I liquids are stored, handled or dispensed and shall be used to delineate and classify service station areas for the purpose of electrical equipment under normal circumstances. It is based on the premise that the installation meets all requirements of NFPA No. 30. Should this not be the case, the inspector shall have the authority to determine the extent of the classified area. A classified area shall not extend beyond an unpierced wall, roof or other solid partition.

SUBSTANTIATION: NFPA No. 30 S/C General Storage and Handling of Flammable and Combustible Liquids has the basic responsibility for classification of electrical areas in service stations. The present text in No. 70 is not in complete agreement with No. 30 and thus presents a conflict. This can be eliminated by:

(1) Revision of the existing test in No. 70, or (2) by dropping requirements contained in these articles and referring No. 30, or (3) by incorporating the table contained in No. 30 into 514-2 of No. 70.

Of the three approaches, number 3 is probably the most attractive since it eliminates the conflict and provides information to the inspector without the need for an additional reference code. Updating the text in No. 70 is not a significant problem since both codes are close in cycles.

PANEL RECOMMENDATION: Unanimously Affirmative.
PANEL RECOMMENDATION: Reject.
PANEL COMMENT: The supporting comment does not justify the proposed change.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 503 -- CLASS III LOCATIONS

503-9(c): Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 70 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
PANEL RECOMMENDATION: Accept as Revised:
In line 6 insert "an approved" before "fitting" delete "approved for the purpose."
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

503-9(d): Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 71 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
PANEL RECOMMENDATION: Accept as Revised:
Delete paragraph and change (e) to (d).
PANEL COMMENT: This paragraph does not seem to provide any specific hazardous location requirements. General requirements for support of light fixtures appear elsewhere in the Code.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

503-17 (New): Reject
SUBMITTER: Kenneth L. Paape, Allen Bradley Co.
PROPOSAL: 72 Add new section as follows:

503-17: Ground-Fault Protection of Equipment, Class III, Divisions 1 and 2.
(a) Ground-fault protection shall be provided for each solidly grounded branch circuit where conductors are not protected against overcurrent in accordance with the ampacities and the circuit is rated more than 50 volts to ground, but exceeding 600 volts phase-to-phase in a Class III, Division 1 or 2 location. The ground-fault protection shall operate to open all ungrounded conductors of the faulted circuit. The maximum setting of the ground-fault protection shall be 10 amperes. Any time-delay in the operation of the ground-fault protection shall be coordinated with the interrupting rating of the branch-circuit disconnecting or controlling means and the rating or setting of the device that provides overcurrent protection for the branch circuit. Exception No. 1: Where the circuit overcurrent protective device has a rating or setting not exceeding 100 amperes.
Exception No. 2: Where an orderly shutdown is required. (See Section 240-12).

(b) The ground-fault protection system installed shall meet the performance requirements of Section 230-95 (b) and (c).

SUBSTANTIATION: It has long been recognized in the electrical industry that arcing ground faults occur which damage equipment extensively because the ground fault current is limited by the impedance of rigid conduit or is not sustained for a sufficient period of time to cause the overcurrent protective device to clear the fault. As a consequence, damage such as shown in the attached photograph can occur with the emission of sparks and molten metal. Such emission can ignite fibers or flyers which may be present in Class III Hazardous Locations. The higher the rating or setting of the overcurrent protective device the greater the probability of extensive damage before the overcurrent protective device responds to the ground-fault current.

Each of the exceptions to the general rule of protecting conductors against overcurrent in accordance with their ampacities (See Section 240-3) exists for a good purpose, but involves some degree of risk. Motor branch circuits are particularly vulnerable because motor driven equipment often includes a source of vibration which in turn can cause insulation to abrade in conduit with the results shown in the photograph. Providing ground-fault protection for equipment in such situations will reduce the risk inherent in circuits where conductors are not protected in accordance with their ampacities.

Similar proposals have been submitted for Class I and Class II hazardous locations.
PANEL RECOMMENDATION: The supporting comment does not justify the proposed change.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 511 -- COMMERCIAL GARAGES, REPAIR AND STORAGE

511-2(f): Accept
SUBMITTER: TSC-Approved for the Purpose
PROPOSAL: 73 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.
SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.
PANEL RECOMMENDATION: Accept as Revised:
In line 7 insert "suitable" between "other" and "material"
delete "approved for the purpose."
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 513 -- AIRCRAFT HANGARS

513-6: Reject
SUBMITTER: O. E. Dillon, Border County Div. IAEI
PROPOSAL: 74 Delete the words "that are or may be." 
SUBSTANTIATION: The use of the word "may" renders this section legally unenforceable. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.
PANEL COMMENT: The supporting comment does not justify the proposed change.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

513-9: Reject
SUBMITTER: O. E. Dillon, Border County Div. IAEI
PROPOSAL: 76 Delete 513-9.
SUBSTANTIATION: This section is practically unenforceable unless the jurisdiction has the manpower to make routine inspection of aircraft in aircraft hangars. See the attached opinion of the San Diego City Attorney.

PANEL RECOMMENDATION: Reject.
PANEL COMMENT: The supporting comment does not justify the proposed change.
VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 514 -- GASOLINE DISPENSING AND SERVICE STATIONS

514-2: Accept
SUBMITTER: Edward C. Sommer NFPA No. 30 S/C General Storage Plan & Comb. Liquids
PROPOSAL: 77 Delete Section 514-2(a) through (g) and replace with the following:
The following table shall be applied where Class I liquids are stored, handled, or dispensed and shall be used to delineate and classify service station areas for the purpose of electrical equipment under normal circumstances. It is based on the premise that the installation meets all requirements of NFPA No. 30. Should this not be the case, the inspector shall have the authority to determine the extent of the classified area. A classified area shall not extend beyond an unpierced wall, roof or other solid partition.

SUBSTANTIATION: NFPA No. 30 S/C General Storage and Handling of Flammable and Combustible Liquids has the basic responsibility for classification of electrical areas in service stations. The present text in No. 70 is not in complete agreement with No. 30 and thus presents a conflict. This can be eliminated by:

(1) Revision of the existing test in No. 70, or (2) by dropping requirements contained in these articles and referencing No. 30, or (3) by incorporating the table contained in No. 30 into 514-2 of No. 70.

Of the three approaches, number 3 is probably the most attractive since it eliminates the conflict and provides information to the inspector without the need for an additional reference code. Updating as changes may be made in No. 30 is not a significant problem since both codes are close in cycles.
503-9(c): Accept

503-9(d): Accept

ARTICLE 503 -- CLASS III LOCATIONS

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 511 -- COMMERCIAL GARAGES, REPAIR AND STORAGE

511-2(f): Accept

SUBMITTER: TSC-Approved for the Purpose

PROPOSAL: 73 See the Technical Subcommittee "Recommendations" under the definition of "Approved for the Purpose" in Article 100.

SUBSTANTIATION: See the TSC "findings" under the definition of "Approved for the Purpose" in Article 100.

PANEL RECOMMENDATION: Accept as Revised:

In line 7 insert "suitable" between "other" and "material"

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 513 -- AIRCRAFT HANGARS

513-8: Reject

SUBMITTER: O. E. Dillon, Border County Div. IAEI

PROPOSAL: Delete 513-8.

SUBSTANTIATION: This section is practically unenforceable unless the jurisdiction has the man-power to make routine inspection of aircraft in aircraft hangars. See the attached opinion of the San Diego City Attorney.

*See Border County Div. IAEI substantiation for CMP 1 Proposal No. 90 for 110-16(a).

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The supporting comment does not justify the proposed change.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 514 -- GASOLINE DISPENSING AND SERVICE STATIONS

514-2: Accept

SUBMITTER: Edward C. Sommer NFPA No. 30 S/C General Storage Plan & Comb. Liquids

PROPOSAL: Delete Section 514-2(a) through (g) and replace with the following:

The following table shall be applied where Class I liquids are stored, handled or dispensed and shall be used to delineate and classify service station areas for the purpose of electrical equipment under normal circumstances. It is based on the premise that the installation meets all requirements of NFPA No. 30 and is not in complete agreement with No. 30 and thus presents a conflict. This can be eliminated by:

(1) Revision of the existing text in No. 70, or (2) by dropping requirements contained in these articles and referencing No. 30, or (3) by incorporating the text contained in No. 30 into 514-2 of No. 70.

Of the three approaches, number 3 is probably the most attractive since it eliminates the conflict and provides information to the inspector without the need for an additional reference code. Updating as changes may be made in No. 30 is not a significant problem since both codes are close in cycles.
I delete paragraph and change (e) to (d).

In line 6 insert "an approved" before "fitting" delete "approved for the purpose."
There is a further advantage since the table proposed for inclusion in No. 70 is more complete and covers classified areas not presently covered in No. 70.

**PANEL RECOMMENDATION:** Accept as Revised. Substitute the words "The following table" with "Table 514-2." Incorporate Table 7-1 from NFPA 30 into 514-2 of NFPA 70. (See enclosed editorial modifications.) In line 3 change "station" to "stations" and delete remainder of Proposal.

**VOTE ON PANEL RECOMMENDATION:**
- AFFIRMATIVE: 16.
- NEGATIVE: Adams.

**COMMENT ON VOTE:**
- EWERS: The last sentence of the proposal should remain: "A classified area shall not extend beyond an unpierced wall, roof or other solid partition." See write-up that was used at the Denver meeting of CMP 14. See also the first paragraph of Panel Recommendation on Proposal No. 87.
- SCHRAM: My notes indicate the change in line 3 was to change "service station areas" to "service stations."

**EXPLANATION OF VOTE:**
- ADAMS: I think a better resolution of the differences between NFPA 30 and this section would be a reference to NFPA 30 at this point. I am opposed to copying other NFPA publications in this NEC.

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**Table 514-2**  
Class I Locations -- Service Stations

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I, Group D Division</th>
<th>Extent of Classified Area</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNDERGROUND TANK</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fill Opening</td>
<td>1</td>
<td>Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.</td>
<td>location.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Up to 18 inches above grade level within a horizontal radius of 10 feet from a loose fill connection and within a horizontal radius of 5 feet from a tight fill connection.</td>
<td></td>
</tr>
<tr>
<td>Vent — Discharging Upward</td>
<td>1</td>
<td>Within 3 feet of open end of vent, extending in all directions.</td>
<td>space.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.</td>
<td></td>
</tr>
<tr>
<td><strong>DISPENSING UNITS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(except overhead type)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pits</td>
<td>1</td>
<td>Any pit, box or space below grade level, any part of which is within the Division 1 or 2 classified area.</td>
<td>location.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The within a dispenser enclosure up to 4 feet vertically above the base except that defined as Division 2. Any within a nozzle boot.</td>
<td>space.</td>
</tr>
<tr>
<td>Dispenser</td>
<td>1</td>
<td>Within a dispenser enclosure above the Division 1 enclosed within a dispenser enclosure isolated from Division 1 by a solid partition or a solid nozzle boot but not completely surrounded by Division 1. Within 18 inches horizontally in all directions from the Division 1 located within the dispenser enclosure.</td>
<td>location.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Any within a dispenser enclosure above the Division 1 enclosed within a dispenser enclosure isolated from Division 1 by a solid partition or a solid nozzle boot but not completely surrounded by Division 1. Within 18 inches horizontally in all directions from the opening of a nozzle boot not isolated by a vapor-tight partition, except that the classified need not be extended around a 90° or greater corner.</td>
<td>spaces.</td>
</tr>
</tbody>
</table>
Table 514-2 -- continued

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor</td>
<td>Up to 18 inches above grade level within 20 feet horizontally of any edge of enclosure.</td>
</tr>
<tr>
<td>Indoor with Mechanical Ventilation</td>
<td>Up to 18 inches above grade or floor level within 20 feet horizontally of any edge of enclosure.</td>
</tr>
<tr>
<td>Indoor with Gravity Ventilation</td>
<td>Up to 18 inches above grade or floor level within 25 feet horizontally of any edge of enclosure.</td>
</tr>
</tbody>
</table>

**Dispensing Units, Overhead Type**

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Within the dispenser enclosure and 18 inches in all directions from the enclosure where not suitably cut off by ceiling or wall. All electrical equipment integral with the dispensing hose or nozzle.</td>
<td></td>
</tr>
<tr>
<td>2 extending 2 feet horizontally in all directions beyond the Division 1 and extending to grade below this classified location.</td>
<td></td>
</tr>
<tr>
<td>2 Up to 18 inches above grade level within 20 feet horizontally measured from a point vertically below the edge of any dispenser enclosure.</td>
<td></td>
</tr>
</tbody>
</table>

**Remote Pump — Outdoor**

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Any pit, box or space below grade level if any part is within a horizontal distance of 10 feet from any edge of pump.</td>
<td></td>
</tr>
<tr>
<td>2 Within 3 feet of any edge of pump, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of pump.</td>
<td></td>
</tr>
</tbody>
</table>

**Remote Pump — Indoor**

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Entire within any pit.</td>
<td></td>
</tr>
<tr>
<td>2 Within 5 feet of any edge of pump, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of pump.</td>
<td></td>
</tr>
</tbody>
</table>
Table 514-2 -- continued

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUBRICATION OR SERVICE ROOM — with Dispensing</td>
<td></td>
</tr>
<tr>
<td>Location: Chins I, Group D, Division 1</td>
<td>Any pit within any unventilated area.</td>
</tr>
<tr>
<td></td>
<td>2 Any pit with ventilation.</td>
</tr>
<tr>
<td></td>
<td>2 up to 18 inches above floor or grade level and 3 feet horizontally from a lubrication pit.</td>
</tr>
<tr>
<td>Dispenser for Class I Liquids</td>
<td>2 Within 3 feet of any fill or dispensing point, extending in all directions.</td>
</tr>
<tr>
<td>LUBRICATION OR SERVICE ROOM — without Dispensing</td>
<td></td>
</tr>
<tr>
<td>Location: Chins I, Group D, Division 2</td>
<td>2 Entire within any pit used for lubrication or similar services where Class I liquids may be released.</td>
</tr>
<tr>
<td></td>
<td>2 up to 18 inches above any such pit, and extending a distance of 3 feet horizontally from any edge of the pit.</td>
</tr>
<tr>
<td>SPECIAL ENCLOSURE INSIDE BUILDING PER 7-2.2</td>
<td></td>
</tr>
<tr>
<td>Location: Chins I, Group D, Division 1</td>
<td>1 Entire enclosure.</td>
</tr>
<tr>
<td>SALES, STORAGE AND REST ROOMS</td>
<td></td>
</tr>
<tr>
<td>Location: Chins I, Group D, Division 1</td>
<td>Ordinary if there is any opening to these rooms within the extent of a Division 1, the entire room shall be classified as Division 1.</td>
</tr>
<tr>
<td>VAPOR PROCESSING SYSTEMS PITS</td>
<td></td>
</tr>
<tr>
<td>Location: Chins I, Group D, Division 1</td>
<td>1 Any pit, box or space below grade level, any part of which is within a Division 1 or 2, or which houses any equipment used to transport or process vapors.</td>
</tr>
<tr>
<td>VAPOR PROCESSING EQUIPMENT LOCATED WITHIN PROTECTIVE ENCLOSURES</td>
<td>2 Within any protective enclosure housing vapor processing equipment.</td>
</tr>
</tbody>
</table>
Table 514-2 -- continued

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I, Group D Division</th>
<th>Extent of Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAPOR PROCESSING EQUIPMENT NOT WITHIN PROTECTIVE ENCLOSURES (excluding piping and combustion devices)</td>
<td>2</td>
<td>The space within 18 inches in all directions of equipment containing flammable vapor or liquid extending to grade level. Up to 18 inches above grade level within 10 ft. horizontally of the vapor processing equipment.</td>
</tr>
<tr>
<td>EQUIPMENT ENCLOSURES</td>
<td>1</td>
<td>Any space within the enclosure where vapor or liquid is present under normal operating conditions.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The entire space within the enclosure other than Division 1.</td>
</tr>
<tr>
<td>VACUUM ASSIST BLOWERS</td>
<td>2</td>
<td>The space within 18 inches in all directions extending to grade level. Up to 18 inches above grade level within 10 feet horizontally.</td>
</tr>
</tbody>
</table>
514-2(a): Reject

SUBMITTER: Gene Wittermaler, Gasoline Pump Manufacturers Assn.

PROPOSAL: 78 Revise as follows:

"(a) Dispenser. The area within a dispenser enclosure up to 4 feet vertically above the base and the area within a nozzle boot of Class I, Division 1 location, except that area defined as Division 2.

The following areas are considered Division 2: Areas within a dispenser enclosure isolated from Division 1 by a solid partition or a solid nozzle boot but not completely surrounded by a Division 1 area.

Within 18 inches horizontally in all directions from the Division 1 area located within the dispenser enclosure. Within 18 inches horizontally in all directions from the opening of a nozzle boot not isolated by a vapor tight partition, except that the classified area need not be extended around a 90 degree or greater corner.

SUBSTANTIATION: This change is needed so that 514-2 will agree with Table 7-1 of Code 30."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-2(h)-(New): Reject

SUBMITTER: Keith Bellamy, Canada, MN

PROPOSAL: 79 Add new (h) as follows:

"(h) The space above the Class I Division 1 locations set out in Section 514-2(a) shall be classified as Class I Division 2 locations, which shall extend to a height of 18 inches above the Class I Division 1 locations. The space between 18 inches and 36 inches horizontally from the dispenser shall be classified as a Class I Division 2 location up to 5 feet 6 inches above the dispenser base.

SUBSTANTIATION: Section 500-4(b)(3) defines a space adjacent to a Class I Division 1 location as a Class I Division 2 location. Section 514-2(c) states that any space within a dispenser up to 4 feet above the base and a space within 18 inches horizontally of the dispenser shall be classified as a Class I Division 1 location. Section 514-2(b) states that any space between the Class I Division 1 location and 20 feet horizontally of the dispenser and up to 18 inches above the driveway shall be classified as a Class I Division 2 location. Nowhere in the Code does it specifically what the space between the Class I Division 1 location and up to 18 inches horizontally from the dispenser is. In other words, there appears to be a void which the above proposal would look after.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-8: Reject

SUBMITTER: H. F. von der Vaart, Cleveland, OH

PROPOSAL: 80 In first sentence delete: "where buried under not less than 2 feet of earth, it shall be permitted in.", and in last sentence delete: "Exception No. 3 of.

SUBSTANTIATION: This reflects intent of Section 300-5(a), which permits burial depths of 18 inches and exceptions thereto.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-8: Accept

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 81 In the fifth line after the word "used," add "threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last two feet of the underground run to emergence."

". The second sentence in Section 514-8 would then read: "Where rigid metal conduit is used, threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last two feet of the underground run to emergence; or to the point of connection to the above ground raceways; an equipment grounding conductor shall be included to provide electrical continuity of the system and for grounding of noncurrent-carrying metal parts."

SUBSTANTIATION: As now written "where not buried under not less than two feet of earth," does not prevent the nonmetallic conduit from being extended directly into a nonhazardous area basement at this level. The nonmetallic conduit cannot be sealed.

PANEL RECOMMENDATION: Accept.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-8: Reject

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 82 Delete all the rest of the Section beyond "or where buried" in the second line which eliminates the use of nonmetallic conduit in a Class I Division 1 area.

SUBSTANTIATION: There is no provision for the possibility of extending the nonmetallic raceway out into a nonhazardous area where grade level is such that the incline will permit this. Nonmetallic conduit cannot be sealed. Article 514 states "where buried under not less than two feet of earth," does not prevent the nonmetallic conduit from being extended directly into a nonhazardous area. No action on this item.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 515 -- BULK-STORAGE PLANTS

515-1 and 515-2(h)-(New): Reject

SUBMITTER: R. S. Pinkerton, Los Angeles, CA

PROPOSAL: 83 Add a new sentence to 515-1 as follows:

"This designation shall also include locations where ships carrying bulk cargos of gasoline or other volatile flammable liquids are loaded or unloaded."

And add a new (h) as follows:

"(h) When the loading and unloading area exceeds 5 feet, and measured from the mean high tide line shall be considered a Class I Division 2 location."

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

515-8: Reject

SUBMITTER: Idaho Chapter IAEI

PROPOSAL: 84 Delete the remainder of the section after the words "threaded rigid metal conduit intermediate metal conduit shall be used for the last two feet of the underground run to emergence" after the words "nonmetallic conduit is used."

SUBSTANTIATION: As now written "where not buried under not less than two feet of earth," does not necessarily prohibit extending the NM conduit directly into a hazardous location in a basement from this burial depth.

PANEL RECOMMENDATION: Reject.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

A survey of National Codes, standards or other publications

244
514-2(a): Reject
SUBMITTER: Gene Wittermayer, Gasoline Pump Manufacturers Assn.
PROPOSAL: 78 Revise as follows:
(a) Dispenser. The area within a dispenser enclosure up to 4 feet vertically above the base and the area within a nozzle boot of a Class I, Division 1 location, except that area defined as Division 2.

The following areas are considered Division 2: Areas within a dispenser enclosure that are not within Area within a dispenser enclosure isolated from Division 1 by a solid partition or a solid nozzle boot but not completely surrounded by a Division 1 area.

Within 18 inches horizontally in all directions from the Division 1 area located within the dispenser enclosure. Within 18 inches horizontally in all directions from the opening of a nozzle boot not isolated by a vapor-tight partition, except that the classified area need not be extended around a 90 degree or greater corner.

SUBSTANTIATION: This change is needed so that 514-2 will agree with Table 7-1 of Code 30.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-2(h)-(New): Reject
SUBMITTER: Keith Bellamy, Canada, MN
PROPOSAL: 79 Add new (h) as follows:

(6) The space above the Class I, Division 1 locations set out in Section 514-2(a) shall be classified as Class I, Division 2 locations, which shall extend to a height of 18 inches above the Class I, Division 1 locations. The Class I, Division 2 space between 18 inches and 36 inches horizontally from the dispenser shall be classified as a Class I, Division 2 location up to 5-6 feet above the dispenser base.

SUBSTANTIATION: Section 500-4(b)(3) defines a space adjacent to a Class I, Division 1 location as a Class I, Division 2 location. Section 514-2(a) states that any space within a dispenser up to 4 feet above the base and a space within 18 inches horizontally of the dispenser up to 4 feet above the base shall be classified as a Class I, Division 1 location. Section 514-2(b) states that any space beyond the Class I, Division 1 location within 20 feet horizontally of the dispenser and up to 18 inches above the driveway shall be classified as a Class I, Division 2 location. Nowhere in the Code does it specify what the space directly above the dispenser or the space above the Class I, Division 1 location surrounding the dispenser are to be classified. Nor does the Code specify what the space beyond the 18 inches horizontally from the dispenser shall be. In other words, there appears to be a void which the above proposal would look after.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-8: Reject
SUBMITTER: R. S. Pinkerton, Los Angeles, CA
PROPOSAL: 80 In first sentence delete: “where buried under not less than 2 feet of earth,” and in last sentence delete: “Exception No. 3 of Art. 514 states, ‘Where buried under not less than two feet of earth,’ does not prevent the nonmetallic raceway out into a nonhazardous area where grade level is such that the incline will permit this. Nonmetallic conduit cannot be sealed. Article 514 states ‘where buried under not less than two feet of earth,’ does not necessarily prohibit extending the NM conduit directly into a nonhazardous area in a basement from this burial depth.”

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-8: Accept
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: 81 In the fifth line after the word “used,” add “threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last two feet of the underground run to emerge.” The second sentence in Section 514-8 would then read: “Where rigid nonmetallic conduit is used, threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last two feet of the underground run to emerge or to the point of connection to the above ground raceways; an equipment grounding conductor shall be included to provide electrical continuity of the system and for grounding of noncurrent-carrying metal parts.”

SUBSTANTIATION: As now written “where not buried under not less than two feet of earth,” does not prevent the nonmetallic conduit from being extended directly into a nonhazardous area at this level. The nonmetallic conduit cannot be sealed.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

514-8: Reject
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: 82 Delete all of the rest of the Section beyond “or where buried” in the second line which eliminates the use of nonmetallic conduit in a Class I, Division 1 area.

SUBSTANTIATION: There is no provision for the possibility of extending the nonmetallic raceway out into a nonhazardous area where grade level is such that the incline will permit this. Nonmetallic conduit cannot be sealed. Article 514 states “where buried under not less than two feet of earth,” does not necessarily prohibit extending the NM conduit directly into a nonhazardous area in a basement from this burial depth.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 515 -- BULK-STORAGE PLANTS

515-1 and 515-2(h)-(New): Reject
SUBMITTER: R. S. Pinkerton, Los Angeles, CA
PROPOSAL: 83 Add a new sentence to 515-1 as follows:

This designation shall also include locations where ships carrying bulk cargos of gasoline or other volatile flammable liquids are loaded or unloaded. And add a new (h) as follows:

(1) The entire horizontal area of the loading dock and the horizontal area extending 35 feet in all directions from the tanker loading dock space within 15 feet measured from the mean high tide line shall be considered a Class I, Division 2 location. The Class I, Division 2 shall also extend, vertically, below the dock to the water and upward to a level of 100 feet above the surface of the loading dock.

Exception: The hazardous location shall not be required to extend more than 18 inches above that portion of the grade, dock or ramp which is more than 35 feet from the ship side of the loading dock.

The Class I, Division 2 location shall extend 25 feet in all directions from the surface of the loading hose manifold.

b. The interior of a building, any portion which is located in a Class I, Division 1 location, shall be classified as a Class I, Division 2 location.

Exception: Buildings which are provided with satisfactory positive pressure ventilation and safeguards and which are not supplied with air from a clean air source may be considered to be a nonhazardous location.

SUBSTANTIATION: Following an explosion aboard an oil tanker which destroyed the ship at its dock in the Los Angeles City harbor a Task Force was appointed to study the causes and recommend regulations that would minimize the chances of another such accident. The Task Force discovered that the Electrical Code requirements dealing with the installation of electrical wiring on tankers did not provide adequate protection. The Task Force recommended changes to the Code.

A survey of National Codes, standards, or other publications
dealing with the handling of flammable liquids or gases revealed that there are no existing standards for electrical systems which are located on tanker loading docks. One publication, the National O1 Tanker and Terminal Safety Guide, did provide helpful background information which enabled the Committee to develop valid, practical standards.

The developers of the safety guide had conducted wind tunnel tests to determine the extent of flammable vapors from the discharge point. These tests provided several different conditions which included various discharge rates of the vapor, various heights above the dock and change of distance from the shipboard superstructures and the effect of shipboard superstructures on the flow of vapors. The extent of the flammable vapors from the discharge point was well delineated and gave the Committee a very real and practical guide in establishing the parameters of locations classified as hazardous.

The recommendations in the O1 Tanker and Terminal Safety Guide are consistent with NFPA Pamphlet No. 497-1975.

CLASSIFICATION OF CLASS I HAZARDOUS LOCATIONS FOR ELECTRICAL INSTALLATIONS IN CHEMICAL PLANTS. Although this pamphlet does not specify requirements on tanker loading docks, it does classify certain areas as hazardous around similar operations such as bulk loading of tanker trucks, bulk loading of railway tank cars and areas around large storage tanks located adjacent to refineries.

The main source of the hazard, obviously, is aboard ship and to be completely accurate, the extent of a hazardous area must be delineated from the tanker vent. The Committee agreed that this would be impractical and unenforceable and so a study was made to determine the extent of the vent, the point that was determined by the results of the wind tunnel tests. The proposed Code requirements are the results of this study. With the tremendous increase in the handling of petroleum products in the nations harbors, it is imperative that the NEC be updated to provide for safe electrical systems installed adjacent to this extremely flammable material.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The scope of Article 515 and the classification of areas is based on NFPA 30, the Panel believes NFPA 30 should be revised before Article 515.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

515-2: Accept

CMR 14

SUBMITTER: Edward C. Sommer, NFPA No. 30 S/C General Storage Tank & Comb. Liquids

PROPOSAL: 87 Delete Section 515-2(a) through (g) and replace with the following:

The following table shall be applied where Class I liquids are stored, handled or dispensed and shall be used to delineate and classify bulk storage plant areas for the purpose of electrical classification of electrical areas in bulk plants. The present text in No. 70 is not in complete agreement with No. 30 and thus presents a conflict. This conflict can be eliminated by:

(1) revision of the existing text in No. 70, or (2) by dropping requirements contained in these articles and incorporating the table contained in No. 70 into No. 515-2 of No. 70.

Of the three approaches, number 3 is probably the most attractive since it eliminates the conflict and provides the inspector without the need for an additional reference code. Updating as changes may be made in No. 30 is not a significant problem since both codes are close in cycles. There is a further advantage since the table proposed for inclusion in No. 70 is more complete and covers classified areas not presently covered in No. 70.

PANEL RECOMMENDATION: Accept as Revised:

"The following table shall be applied where Class I liquids are stored, handled or dispensed and shall be used to delineate and classify bulk storage plant areas for the purpose of electrical classification of electrical areas in bulk plants. The Class I location shall not extend beyond an unpierced wall, roof or other solid partition."

The following Table shall be applied where Class I liquids are stored, handled or dispensed and shall be used to delineate and classify bulk storage plant areas for the purpose of electrical classification of electrical areas in bulk plants.

<table>
<thead>
<tr>
<th>Class 1 Div 1 Location</th>
<th>Class 1 Div 2 Location</th>
<th>Class 1 Div 3 Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>Horizontal</td>
<td>Vertical</td>
</tr>
<tr>
<td>25 feet</td>
<td>35 feet</td>
<td>25 feet</td>
</tr>
<tr>
<td>Extends 25 feet</td>
<td>Extends 35 feet</td>
<td>Extends 25 feet</td>
</tr>
</tbody>
</table>

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

EXPLANATION OF VOTE:

"There is a further advantage since the table proposed for inclusion in No. 70 is more complete and covers classified areas not presently covered in No. 70."

CROFT: In the Panel Recommendation "Table 515-2" should be substituted for "The following table" to agree with Proposal No. 77.

SCRAM: I suggest "the following table" be revised to:

"Table 515-2" to be consistent with Panel Action on Proposal No. 77.

EXPLANATION OF VOTE:

"Same as comment on Proposal No. 77."

245
Table 515-2. Class I Locations -- Bulk Plants

<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TANK VEHICLE AND TANK CAR</strong></td>
<td></td>
</tr>
<tr>
<td>Loading Through Open Dome</td>
<td>1. Within 3 feet of edge of dome, extending in all directions.</td>
</tr>
<tr>
<td></td>
<td>2. Between 3 feet and 15 feet from edge of dome, extending in all directions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Loading Through Bottom Connections With Atmospheric Venting</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Within 3 feet of point of venting to atmosphere extending in all directions.</td>
<td></td>
</tr>
<tr>
<td>2. Between 3 feet and 15 feet from point of venting to atmosphere, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of loading connection.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Loading Through Closed Dome With Atmospheric Venting</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Within 3 feet of open end of vent, extending in all directions.</td>
<td></td>
</tr>
<tr>
<td>2. Between 3 feet and 15 feet from open end of vent, extending in all directions. Also within 3 feet of edge of dome, extending in all directions.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Loading Through Closed Dome With Vapor Recovery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Within 3 feet of point of connection of both fill and vapor lines, extending in all directions.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bottom Loading With Vapor Recovery or Any Bottom Unloading</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Within 3 feet of point of connection extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of connection.</td>
<td></td>
</tr>
</tbody>
</table>

When classifying extent of Class I Location, consideration shall be given to fact that tank cars or tank vehicles may be spotted at varying points. Therefore, the extremities of the loading or unloading positions shall be used.
<table>
<thead>
<tr>
<th>Location</th>
<th>Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PUMPS, BLEEDERS, WITHDRAWAL FITTINGS, METERS AND SIMILAR DEVICES</strong></td>
<td></td>
</tr>
<tr>
<td>Indoors</td>
<td>2 Within 5 feet of any edge of such devices, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of such devices.</td>
</tr>
<tr>
<td>Outdoors</td>
<td>2 Within 3 feet of any edge of such devices, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of such devices.</td>
</tr>
<tr>
<td><strong>STORAGE AND REPAIR GARAGE FOR TANK VEHICLES</strong></td>
<td>1 All pits or spaces below floor level.</td>
</tr>
<tr>
<td></td>
<td>2 up to 18 inches above floor or grade level for entire storage or repair garage.</td>
</tr>
<tr>
<td><strong>DRAINAGE DITCHES, SEPARATORS, IMPOUNDING BASINS</strong></td>
<td>2 up to 18 inches above ditch, separator or basin. Also up to 18 inches above grade level within 15 feet horizontally from any edge.</td>
</tr>
<tr>
<td><strong>GARAGES FOR OTHER THAN TANK VEHICLES</strong></td>
<td>Ordinary If there is any opening to these rooms within the extent of an outdoor location, the entire room shall be classified the same as the area classification at the point of the opening.</td>
</tr>
<tr>
<td><strong>OUTDOOR DRUM STORAGE</strong></td>
<td>Ordinary If there is any opening to these rooms within the extent of an indoor location, the room shall be classified the same as if the wall, curb or partition did not exist.</td>
</tr>
<tr>
<td><strong>INDOOR WAREHOUSING WHERE THERE IS NO FLAMMABLE LIQUID TRANSFER</strong></td>
<td>Ordinary If there is any opening to these rooms within the extent of an indoor location, the room shall be classified the same as if the wall, curb or partition did not exist.</td>
</tr>
<tr>
<td><strong>OFFICE AND REST ROOMS</strong></td>
<td>Ordinary</td>
</tr>
</tbody>
</table>
Table 515-2 - continued

<table>
<thead>
<tr>
<th>Location</th>
<th>Class 1, Group D Division</th>
<th>Extent of Class I Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DRUM AND CONTAINER FILLING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoors, or Indoors</td>
<td>1</td>
<td>Within 3 feet of vent and fill opening, extending in all directions.</td>
</tr>
<tr>
<td>With Adequate Ventilation</td>
<td>2</td>
<td>Between 3 feet and 5 feet from vent or fill opening, extending in all directions. Also up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill opening.</td>
</tr>
</tbody>
</table>

| **TANK — ABOVEGROUND**         |                           |                           |
| Shell, Ends, or Roof and Dike Area | 2                     | Within 10 feet from shell, ends, or roof of tank, inside dikes to level of top of dike. |
| Vent                            | 1                         | Within 5 feet of open end of vent, extending in all directions. |
| Floating Roof                   | 1                         | Above the roof and within the shell. |

| **PITS**                       |                           |                           |
| Without Mechanical Ventilation  | 1                         | Entire within pit if any part is within a Division 1 or 2 classified area. |
| With Mechanical Ventilation    | 2                         | Entire within pit if any part is within a Division 1 or 2 classified area. |
| Containing Valves, Fittings or Piping, and Not Within a Division 1 or 2 Classified Area | 2 | Entire pit. |

*For Tanks — Underground, see Article 514-2.*
S15-5: Reject
SUBMITTER: H. F. van der Voort, Cleveland, OH
PROPOSAL: 88 In first sentence delete: "where buried under not less than 2 feet of earth, it shall be permitted in." After second sentence change to Section 300-5(a), which
SUBSTANTIATION: This reflects intent of Article 300-5(a), which permits burial depths of 18 inches and all the exceptions thereto.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The present requirement is necessary because of normal heavy vehicular traffic.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

S15-5(a): Accept
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: 90 In the 5th line of Section S15-5(a), after the word "purpose," add the following sentence: "Where rigid nonmetallic conduit is used, threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used for the last two feet of the conduit run to emergence or to the point of connection to the above ground raceway." The rest of the section to remain unchanged.

SUBSTANTIATION: Section S15-5, as it is now written, misleadingly permits rigid nonmetallic conduit to emerge from its minimum required buried depth of two feet by directly requiring cable to be enclosed in threaded rigid or threaded steel intermediate conduit from point of lowest buried cable level.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 90.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

S15-5(c): Reject
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: 92 Delete "with a nonmetallic sheath" from the second line. After "cable" in the first line, add "approved for the purpose." It will then read: "Where rigid nonmetallic conduit or cable approved for the purpose is used...." (Rest of Section to remain unchanged.)

SUBSTANTIATION: The phrase "cable with a nonmetallic sheath" can be misleading to include UF cable.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: The present wording adequately reflects the Panel's intent.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

S15-5(c): Reject
SUBMITTER: Idaho Chapter IAEI
PROPOSAL: 93 Revise as follows: "Where rigid nonmetallic conduit or cable approved for the purpose is used...." (Rest of Section to remain unchanged.)

SUBSTANTIATION: The phrase "cable with a nonmetallic sheath" can be misleading to include UF cable.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: See Panel action on Proposal No. 92.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

515-5(c): Reject CMP 14
SUBMITTER: Chet Moyes, Allen Knickrehm
PROPOSAL: 94 Revise Article 516 as follows:
(1) "Conclusion: by adding second sentence: "This Article also covers electroplating and electrolytic finishing processes."
(2) Make the present wording "Article 516 Part A-Liquid Finish Processes."
(3) Make new "Part B-Electrolytic Finish Processes."
(4) Add:
516-xx. General. Equipment for use in electrolytic finishing process shall be of a type intended for such service.
516-xx. Branch-Circuit Conductor. The branch-circuit conductor supplying one or more units of equipment to a source of supply shall have an ampacity of not less than 125 percent of the total connected load.
516-xx. Secondary Wiring. The conductor connecting the electrolyte tank equipment to the regulating or conversion equipment shall be permitted to be open as wiring not on insulator, provided:
(a) they are protected from physical damage;
(b) they operate at 25 volts or less.
516-xx. Busbars. Open noninsulated busbars shall be permitted to be installed over or adjacent to electrolyte containers, provided:
(a) signs are posted to indicate open electric conductors are present;
(b) the busbars occur only in the areas where electrical connection is required.
516-xx. Overcurrent Protection. Secondary and busbars shall be protected from overcurrent by one or more of the following:
(a) fuses or circuit breakers;
b) a current sensing device which operates a disconnecting means;
(c) an inherently current limiting equipment or apparatus which by its design and construction, will limit overcurrent to 100% of normal—reduce output voltage—de-energize the secondary conductors if an overcurrent continues for a set length of time; not more than five minutes.
SUBSTANTIATION: The present NEC rules do not cover the electroplating industry. When inspectors apply the NEC rules open conductors necessary are not permitted. This, of course, cannot be permitted. This proposal is an attempt to correct this situation. See attached letter for further supporting comment.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Outside the scope of CMP 14.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

S16-2(b)(5): Reject
SUBMITTER: Nicholas J. Talbot, NFPA Finishing Processes Committee
PROPOSAL: 95 Change 20 feet horizontal dimension to 25 feet.

SUBSTANTIATION: Conflict with the intent of NFPA 34.

PANEL RECOMMENDATION: Reject.

PANEL COMMENT: Pending final action on NFPA 34.

VOTE ON PANEL RECOMMENDATION: Unanimously Affirmative.

ARTICLE 516 -- FINISHING PROCESSES

516-100. Definition of "Approved for the Purpose" in Article 300-5(a). This reflects intent of Article 300-5(a), which does not indicate that certain powder coating operations need Class II installations. The NFC does not do this as powder coating that requires Class II installations is not covered.

516-102. Correction of Error.

CORRECTION OF ERROR.

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