

**SEMINAR 301 Part 1:**  
Changes in the 2005 NEC

**ELECTRIC and NEON  
SIGN STANDARDS**

**By Randy Wright  
RKW CONSULTING  
[www.rkwconsulting.org](http://www.rkwconsulting.org)**

**SEMINAR RULES:**

- There are no Rules
- All Questions need to be asked
- Stop at any time for an explanation

**SEMINAR PARTS:**

- Part 1: Overview and layout of the National Electric Code as it relates to the electric sign industry. Changes from 2002 to the 2005 Code
- Part 2: UL Standards Changing
- Part 3: Litigation and how we become involved

**Your Presenter:** Randall K. Wright RKW CONSULTING

- 36 Years in the electric sign industry
- 16 Years consulting as an electric and neon sign system specialist
- 31 Years in the fire service
- Seminar presentation for education
- Consultant for United States Sign Council

**Voting (Special Expert) member NEC Code Panel 18**

1987-2002 as Association Member 2008- Currently as Consultant

**Member of four UL STPs: Standards Technical Panels**

- UL 48 Electric Signs
- UL 2161 Transformers and Power Supplies
- UL 814 GTO Wire
- UL 879 Sign Components

**Writes for:**

- Sign Builder Magazine
- I.A.E.I news
- USSC Newsletter
- NeonInstallationGuide
- [WWW.signindustry.org](http://WWW.signindustry.org)

### Fire Investigation:

- Provide Cause and Origin information for Neon Signs
- Expert testimony for Neon Sign Fire cases
- Trial and Deposition Demonstrations
- Code Authorities on Neon Sign Fire Prevention

### Provide review and edit information:

- Neon Lighting (IAEI Manual)
- NeonInstallationGuide
- UL 48, 879, 814, 2161
- NEC
- NEW: [www.signindustry.org](http://www.signindustry.org)

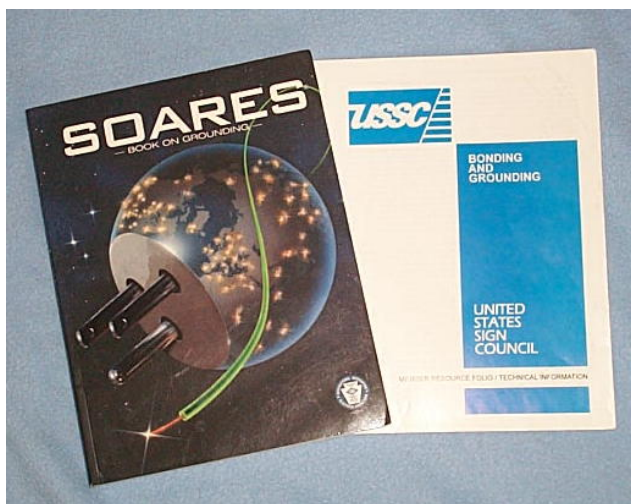
# Tools of the Trade



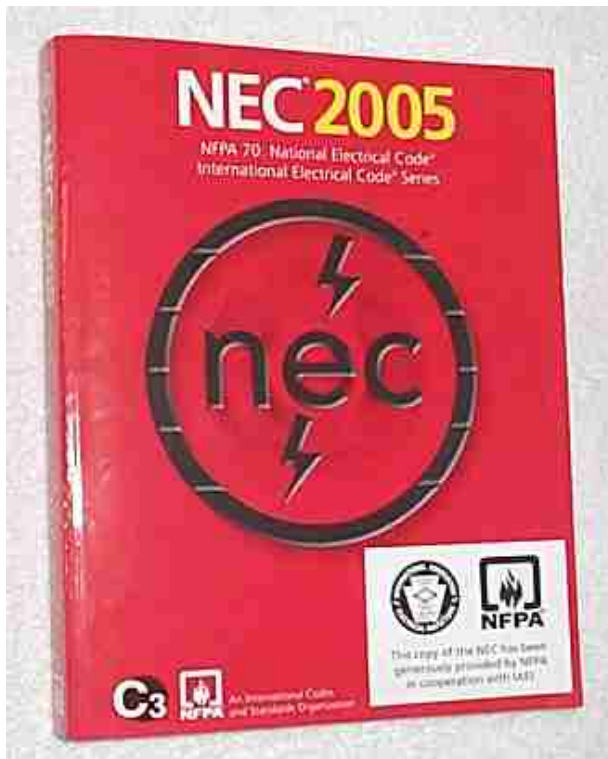
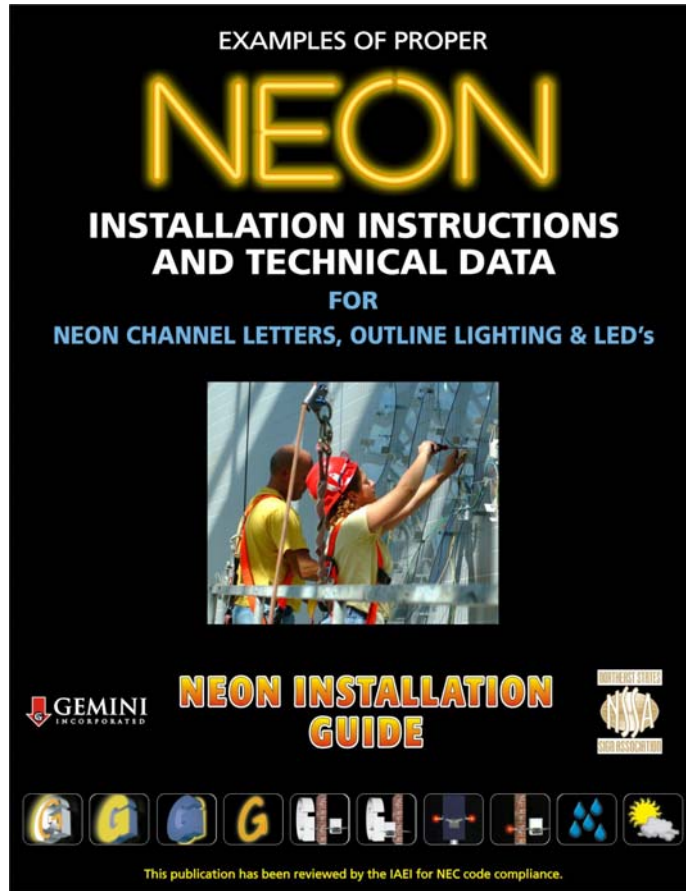
# Tool of the Trade



I.A.E.I. Neon  
Lighting book  
concerning Electric  
Signs and Outline  
Lighting  
Available from your  
Association



E.I. Soares book  
concerning Bonding  
and Grounding  
USSC Technical  
Manual  
Available from your  
Association



Current NEC



**NATIONAL FIRE PROTECTION ASSOCIATION**  
**NFPA 70 2005 NEC**  
**National Electric Code**  
**Changes**

2002 NEC Code: 80.1 Scope  
Moved to ANNEX G: Administration

The following functions are covered:

- (1) The inspection of electrical installations as covered by 90.2
- (2) The investigation of fires caused by electrical installations
- (3) The review of construction plans, drawings, and specifications for electrical systems
- (4) The design, alteration, modification, construction, maintenance, and testing of electrical systems and equipment
- (5) The regulation and control of electrical installations at special events including but not limited to exhibits, trade shows, amusement parks, and other similar special occupancies

2002 NEC Code: 80.2 Definitions  
Moved to ANNEX G: Administration

80.2 Definitions. Authority Having Jurisdiction. (AHJ) The key wording is "responsible for approving" The terminology of approving is misused quite frequently in our industry. You hear a lot of us saying "that is UL approved" when UL does not approve anything. They List, Recognize, or Classify products. Only an electrical inspector (AHJ) can approve an installation.

2002 NEC Code: 80.5 Adoption  
Moved to ANNEX G: Administration  
80.5 Adoption.

Article 80 shall not apply unless specifically adopted by the local jurisdiction adopting the National Electrical Code.

2005 NEC Code: 80.5 Adoption

Commentary:

This means the document (The NEC) is only a good reference unless the local jurisdiction adopts the Code by ordinance

2005 NEC Code: 80.5 Adoption

Commentary

Most building codes Like B.O.C.A, U.B.C, S.B.C etc all have sections which refer to Electrical Utilization equipment must be installed per NFPA 70 Some will adopt it verbatim and some will modify with local rules. Know your jurisdiction.

2005 NEC Article 90.1 Introduction

No Changes

90.1 Purpose.

(A) Practical Safeguarding. The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity.

(B) Adequacy. This Code contains provisions that are considered necessary for safety. Compliance therewith and proper maintenance will result in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use.

**Proper Maintenance?**

2005 NEC Code: Commentary



Installation, Service and Maintenance of any neon sign can cause you to become involved. Train your installers and service personnel. They are the first line of defense from a lawsuit. Don't be afraid to walk away from a bad job.

90.1 Purpose

Adding reference to other

**(D) Relation to Other International Standards.**

The requirements in this *Code* address the fundamental principles of protection for safety contained in Section 131 of International Electrotechnical Commission Standard 60364-1, *Electrical Installations of Buildings*.

2005 NEC Code: 90.3 Arrangement

No Changes

Chapter 1 General

Chapter 2 Wiring and Protection

Chapter 3 Wiring methods and Materials

Chapter 4 Equipment for General Use

*These Sections Apply to all installations*

2005 NEC Code: 90.3 Arrangement

No Changes

Chapter 5 Special Occupancies

Chapter 6 Special Equipment

Chapter 7 Special Conditions

*Supplements or modifies Chapter 1-4*

2005 NEC Code: 90.3 Arrangement

No Changes

Chapter 8 Communications

Chapter 8 is not subject to Chapter 1-7 unless specifically referenced in Chapter 8.

2005 NEC Code:

Commentary

Article 600 will supplement or modify the general rules. Example where we can use a total of 100' of flexible metal conduit as a bonding means in a secondary circuit. The general rule is 6'

2005 NEC Code: 90.7

No Changes

Examination of Equipment for Safety.

It is the intent of this Code that factory-installed internal wiring or the construction of equipment need not be inspected at the time of installation of the equipment, except to detect alterations or damage, if the equipment has been listed by a qualified electrical testing laboratory that is recognized as having the facilities described in the preceding paragraph and that requires suitability for installation in accordance with this Code.

2005 NEC Code: **Article 100 Definitions**                      No Changes

**Scope.** This article contains only those definitions essential to the proper application of this Code. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Other definitions are included in the article in which they are used but may be referenced in Article 100.

Part I of this article contains definitions intended to apply wherever the terms are used throughout this *Code*.

Part II contains definitions applicable only to the parts of articles specifically covering installations and equipment operating at over 600 volts, nominal.

2005 NEC Code: **Article 100 Definitions**                      (Only related to our industry)

**Authority Having Jurisdiction (AHJ).** The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

AHJ added to FPN as well

**Outline Lighting.** An arrangement of incandescent lamps, electric discharge lighting, or other electrically powered light sources to outline or call attention to certain features such as the shape of a building or the decoration of a window.

*To add LED's and other light sources to the code*

2005 NEC Code: **Article 110**    Requirements for Electrical Installations

**110.1 Scope.**

This article covers general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment, and tunnel installations.

**110.1 Scope.**    Commentary

This section of the code is where authority is drawn for those lighted catwalks behind every set of remote wired letters

**I. General**

Added personnel entry

110.1 Scope. This article covers general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment; enclosures intended for personnel entry; and tunnel installations.

110.2 **Approval.** The conductors and equipment (SIGNS) required or permitted by this Code shall be acceptable only if approved.



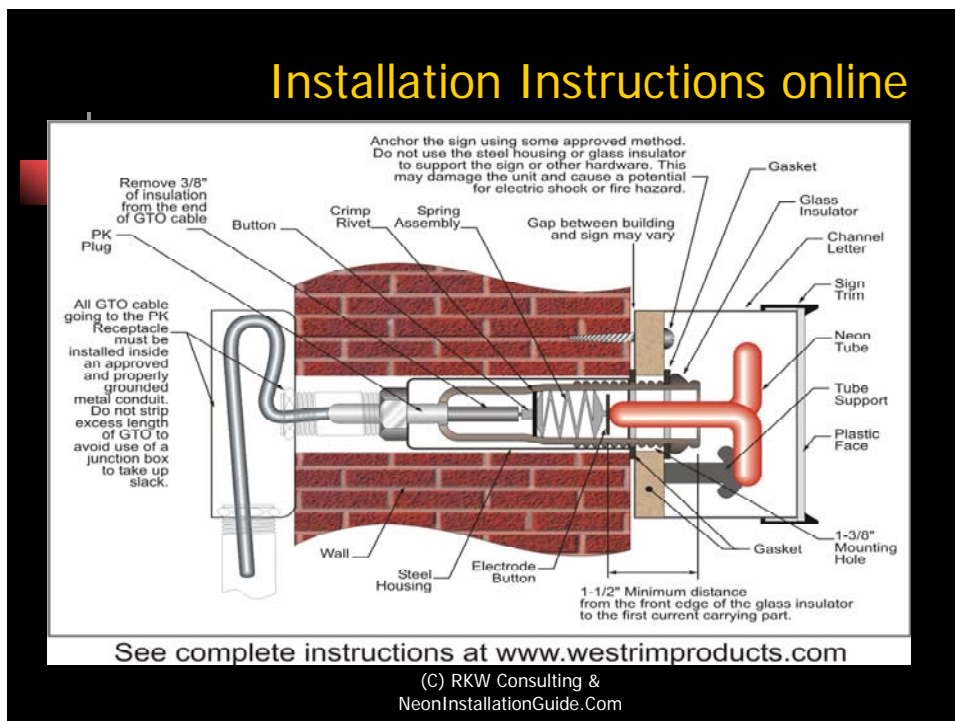
2005 NEC Code: Article 110  
Requirements for Electrical Installations

110.3 No Changes  
(B) **Installation and Use.** Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.

110.3 Commentary

This section is where the authority is drawn for installing a product in accordance with the manufacturers “**Installation Instructions**”

Where “**Conditions of Acceptability**” must be followed not abused



2005 NEC Article 250 **Grounding and Bonding** Title change

**250.2 Definitions.** Added for clarity  
**Effective Ground-Fault Current Path.** An intentionally constructed, permanent, low-impedance electrically conductive path designed and intended to carry current under ground fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground fault detectors on high-impedance grounded systems.

## 250.8 Connection of Grounding and Bonding Equipment.

Grounding conductors and bonding jumpers shall be connected by exothermic welding, listed pressure connectors, listed clamps, or other listed means. Connection devices or fittings that depend solely on solder shall not be used. Sheet metal screws shall not be used to connect grounding conductors or connection devices to enclosures.

2005 NEC Article 250

### II System Grounding

No changes

## VI Equipment Grounding and Equipment Grounding Conductors Bonding

**250.112 Fastened in Place or Connected by Permanent Wiring Methods (Fixed) – Specific.** Exposed, non-current carrying metal parts of the kinds of equipment described in 250.112(A) through (K), and non-current-carrying metal parts of equipment and enclosures described in 250.112(L) and (M), shall be grounded regardless of voltage.  
*(No changes from 2002)*

## VI Equipment Grounding and Equipment Grounding Conductors Bonding

### 250.119 Identification of Equipment Grounding Conductors.

Unless required elsewhere in this *Code*, equipment grounding conductors shall be permitted to be bare, covered, or insulated. Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green or green with one or more yellow stripes except as permitted in this section. Conductors with insulation or individual covering that is green, green with one or more yellow stripes, or otherwise identified as permitted by this section shall not be used for ungrounded or grounded circuit conductors  
*(color added for insulation)*

2005 NEC Article 300 Wiring Methods

### 300.3 Conductors.

**(A) Single Conductors.** Single conductors specified in Table 310.13 shall only be installed where part of a recognized wiring method of Chapter 3.

*Exception: Individual conductors shall be permitted where installed as separate overhead conductors in accordance with 225.6. Exception added*

2005 NEC Article 310 Conductors for General Wiring

**310.5 Minimum Size of Conductors.** The minimum size of conductors shall be as shown in Table 310.5, except as permitted elsewhere in this *Code*.

*600 Modifies this section to allow GTO to be used in 18 and 14 AWG over 1000 volts*

## 2005 NEC Article 310 Conductors for General Wiring

### 310.8 Locations.

**(D) Locations Exposed to Direct Sunlight.** Insulated conductors or cables used where exposed to direct rays of the sun shall comply with one of the following:

- (1) Cables listed, or listed and marked, as being sunlight resistant
- (2) Conductors listed, or listed and marked, as being sunlight resistant
- (3) Covered with insulating material, such as tape or sleeving, that is listed, or listed and marked, as being sunlight resistant

*Made into a list and added the covering material (Sleeving)*

## 2005 NEC Article 314 Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fittings; and Manholes Handhole Enclosures

*Title changed to remove Manhole reference*

**314.1 Scope.** This article covers the installation and use of all boxes and conduit bodies used as outlet, device, junction, or pull boxes, depending on their use, and handhole s and other electrical enclosures. Intended for personal entry

Cast, sheet metal, nonmetallic, and other boxes such as FS, FD, and larger boxes are not classified as conduit bodies. This article also includes installation requirements for fittings used to join raceways and to connect raceways and cables to boxes and conduit bodies.

*Removed the personal entry restriction.*

**314.29 Boxes, Conduit Bodies, and Handhole Enclosures to Be Accessible.** Boxes, conduit bodies, and handhole enclosures shall be installed so that the wiring contained in them can be rendered accessible without removing any part of the building or, in underground circuits, without excavating sidewalks, paving, earth, or other substance that is to be used to establish the finished grade.

*Exception: Listed boxes and handhole enclosures shall be permitted where covered by gravel, light aggregate, or noncohesive granulated soil if their location is effectively identified and accessible for excavation.*

*Handhole enclosure was added*

## 2005 NEC Article 356

### Liquidtight Flexible Nonmetallic Conduit: Type LFNC

**356.12 Uses Not Permitted.** LFNC shall not be used as follows:

- (1) Where subject to physical damage
- (2) Where any combination of ambient and conductor temperatures is in excess of that for which the LFNC is approved
- (3) In lengths longer than 1.8 m (6 ft), except as permitted

by 356.10(5) or where a longer length is approved as essential for a required degree of flexibility

(4) Where the operating voltage of the contained conductors is in excess of 600 volts, nominal, except as permitted in 600.32(A)

(5) In any hazardous (classified) location other than as permitted in 501.10(B), 502.10(A) and (B), 503.10(A), and 504.20

*Reference added to article 600 to modify.*

## 2005 NEC Article 356 Liquidtight Flexible Nonmetallic Conduit: Type LFNC

### 356.20 Size.

(A) **Minimum.** LFNC smaller than metric designator 16 (trade size 1/2) shall not be used unless permitted in 356.20(A)(1) through (A)(3) for metric designator 12 (trade size 3/8).

(1) For enclosing the leads of motors as permitted in 430.245(B)

(2) In lengths not exceeding 1.8 m (6 ft ) as part of a listed assembly for tap connections to luminaires (lighting fixtures) as required in 410.67(C), or for utilization equipment

(3) For electric sign conductors in accordance with 600.32(A)

*No change, reference to signs*

## 2005 NEC Code ARTICLE 410 Luminaires (Lighting Fixtures), Lampholders, and Lamps

**410.1 Scope.** This article covers luminaires (lighting fixtures), lampholders, pendants, incandescent filament lamps, arc lamps, electric-discharge lamps, decorative lighting products, lighting accessories for temporary seasonal and holiday use, portable flexible lighting products, and the wiring and equipment forming part of such lamps, luminaires (fixtures), products and lighting installations.

*Wording changed to include other items and define them all as products.*

## 2005 NEC Code: Article 600 Electric Signs and Outline Lighting , Part I

### I. General

**600.1 Scope.** This article covers the installation of conductors and equipment for electric signs and outline lighting. All installations and equipment using neon tubing, such as signs, decorative elements, skeleton tubing, or art forms, are covered by this article.

*Scope statement completely rewritten based on input from the (TCC) Technical Correlating Committee.*

## 600.2 Definitions.

**Section Sign.** A sign or outline lighting system, shipped as subassemblies, that requires field-installed wiring between the subassemblies to complete the overall sign.

*New definition added to try and clarify a section sign and subassemblies for a Listed sign.*

**600.3 Listing.** Electric signs, section signs, and outline lighting – fixed, mobile, or portable – shall be listed and installed in conformance with that listing, unless otherwise approved by special permission.

*Section signs was added for clarity.*

**600.8 Enclosures.** Live parts, other than lamps, and neon tubing shall be enclosed. Transformers and power supplies provided with an integral enclosure, including a primary and secondary circuit splice enclosure, shall not require an additional enclosure.

*Rewritten from an exception to positive language.*

**600.12 Field-Installed Secondary Wiring.** The field-installed secondary circuit wiring of section signs shall comply with 600.31 if 1000 volts or less, or with 600.32 if over 1000 volts.

*New section in an attempt to fix the inspection problem with Listed section letter signs.*

**600.24 Class 2 Power Sources.** In addition to the requirements of Article 600, signs and outline lighting systems supplied by Class 2 transformers, power supplies, and power sources shall comply with 725.41.

*This section added to allow for low voltage LED power supplies.*

**600.31 Neon Secondary-Circuit Conductors, 1000 Volts or Less, Nominal.**

**(B) Insulation and Size.** Conductors shall be listed, insulated, and not smaller than 18 AWG.

*Removed Listed for the purpose; TCC request but should have been opposed since many products used in our industry is Listed but for another purpose. IE: 600 volt Computer bushing.*

**600.32 Neon Secondary Circuit Conductors, Over 1000 Volts, Nominal**

**(H) Between Neon Tubing and Midpoint Return.** Conductors shall be permitted to run between the ends of neon tubing or to the secondary circuit midpoint return of listed transformers or listed electronic power supplies and provided with terminals or leads at the midpoint.

*Removed Listed for the purpose; TCC request but should have been opposed since many products used in our industry is Listed but for another purpose.*

#### **600.42 Electrode Connections**

(D) **Receptacles.** Electrode receptacles shall be listed.

(G) **Electrode Enclosures.** Electrode enclosures shall be listed.

*Removed Listed for the purpose; TCC request but should have been opposed since many products used in our industry is Listed but for another purpose*

#### **2005 NEC Code: Article 725 III Class 2 and Class 3 Circuits**

##### **III. Class 2 and Class 3 Circuits**

##### **725.41 Power Sources for Class 2 and Class 3 Circuits.**

(A) **Power Source.** The power source for a Class 2 or a Class 3 circuit shall be as specified in 725.41(A)(1), (A)(2), (A)(3), (A)(4), or (A)(5):

*For LEDS and other low voltage equipment*