



JCR Productions, Inc.
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POWER QUALITY AND 2020 CODE CHANGES

8 Core CEU

Course Syllabus

Description

This is an interactive workshop focused on learning and/or reviewing multiple concepts that are essential for active electrical contractors. The emphasis is on learning, refreshing, and improving one's knowledge and exposure of the National Electrical Code. 2020 NEC® changes are added into each topic throughout the day providing applicability of each change to tradesmen daily tasks.

Method of Instructional Delivery

Classroom – lecture, discussion of topics, and hands-on problem solving and calculations

Learning Objectives

- 1) Licensees will demonstrate improved navigation skills within the NEC® by getting them actively into the code.
- 2) Licensees will learn problem-solving techniques by actively working through mathematical processes required for load and feeder calculations, ampacities, determining appropriate overcurrent protection.
- 3) Licensees will learn alternate and more efficient solutions for problems faced in the field especially as it relates to power management.
- 4) Licensees will learn and evaluate 2020 NEC® changes as it relates to electrical work and their individual specialization.

7:30am-8am: Registration

Participants are required to sign a state-specific roster(s) and show a government issued picture ID upon entering the workshop and again at the end of class. Class sign in begins at 7:30am as workshops begin promptly at 8am. Arriving late or leaving early will result in non-reporting of hours. Students are provided a written explanation of attendance and transfer policies at the time of their workshop confirmation.

Outline of Day 8am-4pm

Power Quality and Energy Management 8am-12pm

The 2020 NEC introduces sweeping revisions for both safety and in meeting the evolving demands of power created by new and affordable technologies. This morning portion of the course covers corrective and improved action prompted within the code. By reviewing fundamentals of what an electrician needs to know to meet the higher levels of efficiency within the individual parts of the A/C system, this section will address the electrical system from Article 210 and working in to the service, as directed by the National Electrical Code.

An outline of this portion of the course includes an overview of the electrical system; loads and utilization of equipment; analysis of metering and distribution; wiring methods assessment; utility provider delivery method; power performance study; equipment corrections and far point assessment; analysis and logistics; preparation of corrective and/or improved performance valves and time related payback; and preparation of corrective or improved performance installation and timeline.

*Breakdown of Power Quality and Energy Management:
25 Slides*

Overview of Article 750 (30 min)

Installation and Operation of Energy Management Systems; Loads not to be overridden; Assessment, Control, Monitoring, and Management; Correction, Recovery, Improvement, and Control.

Utility Energy Quality (30 min)

Clarifying and explaining the questions of utility energy quality. Age of delivery system from the utility; environmental impacts affecting delivery; current voltage and sign wave under load; is there lead or lag in the phase sign wave; connection termination provisions; conductor properties provided; is delivery a shared system by utility.

Six Phases of the Process Flow (10 min)

Assessment of Utility and Feeder; Analysis of Overall System; Review, Cost, and Outcomes; Recovery, Methods, Tasks, and Materials; Payback for Recovery Process; Control and Monitoring.

Eight Fundamentals of the Process (20 min)

Overview of assessment of system; Analysis of supplied energy or power delivery; loads and utilization equipment; metering and distribution provisions; wiring methods assessment; system power study; system correction analysis; corrective actions and materials.

System Assessment Factors (30 min)

Quality of delivered energy; distribution method within system; utilization equipment within system; installation methods; heat signature of components and system; distances of distribution and utilization; age of system and components; HVAC, motors, lighting, and appliance loading

Power Quality and Thermal Imaging (20 min)

Use of thermal imaging for system assessment; discovery and correct aspects of overall system improvements; support applications with imaging cameras provide time dating video assessment for condition of motors; online training or formal certification programs through manufacturer.

Properties of Resistance (10 min)

Current flow from utility provider is measured in resistance; assessment of conductor resistance and adjustment can provide large adjustment factors in equipment loads; Chapter 9, Tables 8 and 9 of NEC for basic resistance of conductors; voltage drop analysis providing information in the resistance assessments.

Methods of Installation (10 min)

Evaluation of existing installation methods; assessment of terminations; review overcurrent and short-circuit applications; bonding and grounding vs fault pathways; raceways and junction boxes evaluating; condition of feeder and distribution equipment.

Delivery vs Usage (10 min)

System usage in combined overall loads; amount of energy used from delivery versus loads; loads that can be managed or scheduled; percentage of loss and recovery; impact of loads due to condition or performance; impact of installation methods existing; accurate calculation of kilowatt usage to loss.

System Analysis Results (10 min)

Correction and update of installation methods; reduction of resistance within system; upgrade of equipment and/or controlled or monitored; shedding of loads and scheduled usage; reduction of heat within system; improvement of distribution; correction of utility delivery; increased kilowatt to usage rating; economic recovery of cost through time-based payback.

Process Evaluation (10 min)

Format collected information for overall system assessment; identify areas for improvement or corrective actions; list upgrade options for improved performance and reductions; develop an equipment and material list from survey assessments; develop and produce a recovery plan of action-by-action phases; assess and overview of recovery and payback timeline; prepare a recovery presentation with plan of action assessments; recovery presentation with timeline, cost, and payback conclusions.

Referencing the National Electrical Code (30 min)

Article 220; Article 310; Article 430; Article 420-490; Article 750; Chapter 9- Table 4, 5, 8, 9.

12pm-1pm: Students are able to eat lunch during this instruction time

NEC 2020 Code Changes 12pm-4pm

*Breakdown of NEC 2020 Code Changes:
60 Slides*

Communications: 30 minutes

Article 805 will cover the general requirements for communications systems including communications circuits, community antenna distribution systems, and broadband systems. Clarification of definitions will also be covered within this section to include Article 100 changes.

Four New Articles (15 min)

Article 242 Overvoltage Protection; Article 311 Medium Voltage Conductors; Article 337 Type P Cable; Article 800 General Requirements for Communications

Article 100- Definitions (15 min)

Article 110 Requirements for Installations; Article 110.22(A) Identification of Disconnect Means

Overcurrent & Overvoltage Protection: 90 minutes

Changes to GFCI protection will be addressed highlighting Article 240 with additional specialty references within Chapters 5, 6, and 7. New standards in electrical safety will be discussed with the most significant change being the increase of amp protection ratings across all receptacle outlets (both indoor and outdoor) wherever GFCE protection is required. Article 242 - Overvoltage Protection is also reviewed.

Article 200- Use and Identification of Grounded Conductors (30 min)

210.8- GFCI Protection for Personnel; 210.11- Branch Circuits Required; 210.52- New Requirements for Receptacle layout on island and peninsulas; 215.9- Feeders in GFCI in Readily accessible location; Table 220.12 General lighting loads by non-dwelling occupancy; 220.42- Lighting load demand factors; 220.53- Appliance Load- dwelling unit; 220.46- Spliced and Tapped conductors; 230.63- Barriers at service panels, switchboards, and switchgear; 220.67- Surge protection for dwelling units; 230.85- Emergency disconnect at a readily accessible location; 240.6- Restricted access for adjustable trip breakers required; 240.6- Restricted access for adjustable trip breakers required; 240.88- No molded case breakers can be reconditioned

Article 242 - Overvoltage Protection (30 min)

This article replaces Article 280 Surge arresters, over 1,000V and Article 285 Surge protective devices, 1,000V or less. Those have now been relocated into part II, 1,000V or less, and part III, over 1,000V.

Article 200 continued... (30 min)

250.25- Grounding systems on the supply side of the disconnect; 250.64(A)- Grounding electrode conductor installation in aluminum or copper-clad aluminum conductors; 250.64- Grounding electrode conductor protection from physical damage; 250.68- Grounding electrode conductor connections in rebar system; 250.104- Bonding of metal water piping systems requirements; 250.109- Metal enclosures and connect bonding jumpers or equipment grounding conductors; 250.121- Restricted use of metal frames as equipment grounding conductors; 250.122- Resizing EGC to provide effective ground fault current path; 250.148- Continuity of equipment grounding conductors in boxes

Ampacity Reorganization: 110 minutes

The reorganization of Article 310 within the 2020 NEC is discussed including the new user-friendly numbering system for important ampacity tables. Medium voltage conductors and Type P armored and unarmored cable are addressed. The new definition for cable bundle in Article 725 is reviewed.

Article 300 (20 min)

300.4- Alternative metal fittings: protection against physical damage; 300.7- Sealings in raceways exposed to different temperatures; 300.15- Boxes, conduit bodies, or fittings- where required; 300.22- Air handling areas beneath raised floors for IT rooms; 300.25- Exit enclosures; 300.45- Danger signs

Article 310 - Conductors for General Wiring (30 min)

This article has been extensively reorganized and separated for clarity

Article 300 continued... (30 min)

310.12- New dwelling table; 311- Medium voltage cable; 312.8- addresses energy management equipment; 314.16- Volume allowance for EGCs and equipment bonding jumpers; 314.27- Outlet boxes for ceiling suspended paddle fans; 320.80- Adjustment factors of type AC cable; 330.130- Type MC cable "TC-ER-HL" in hazardous (classified) locations; 334.2- Deletion of references to type NMS cable; 334.30- Measuring type NM cable from the enclosure; 337- Type P cable; 338.2- Service entrance conductor assembly; 342.10- Intermediate metal conduit (type IMC); 342.14- Type IMC of dissimilar metals; 344.10- Uses of permitted of red brass RMC; 350.10- Permitted uses of LFMC; 380.12- Uses not permitted for multi-outlet assembly

Article 400- Flexible Cords and Flexible Cables (30 min)

402.3- New type of fixture wire- FFHH-2; 404.7- Visibility requirements for switches and circuit breakers; 406.9- Receptacle limitations in bathrooms; 406.12- Tamper-resistant receptacles; 406.13- Single pole separable-connector type; 408.6- Short-circuit current ratings of switchboards, switchgear, and panelboards; 445.18- Emergency shutdown of one and two family dwelling units; 450.9- Horizontal top surfaces of transformers prohibited as a storage area

Materials and Instructional Aids

Workshop participants are provided with a **POWER QUALITY AND 2020 NEC® CHANGES** workbook. Participants must bring an NFPA-70E, National Electrical Code 2020 Edition. They are suggested to bring a notebook and a calculator to class. Instructor utilizes a PowerPoint presentation throughout instruction.

Availability of Courses to the General Public

All submitted courses are open to the public for registration and attendance.

Evidence of Completion

Each participant is provided with a Certificate of Completion at the end of class. JCR Productions, Inc. retains original copies of all signed rosters and has electronic copies kept indefinitely.

Cost

\$225.00 - includes workshop & workbook.

Class Location & Size Workshops are held monthly at the following locations:

Hampton Inn & Suites, 3920 Arrow Drive, Raleigh, NC 27612 - Maximum class size: ~40 students

Springhill Suites by Marriott, 121 Gateway Blvd, Mooresville, NC 28117 - Maximum class size: ~40 students

Comfort Inn and Suites, 890 Brevard Rd, Asheville, NC 28806 - Maximum class size: ~40 students

Instructor

Victor Ring, Code Consultant, JCR Productions, Inc.