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Advanced Florida Building Code including the
Electrical Provisions of the Building, Energy
Conservation, Residential, and Existing Building
Volumes — Internet (RV-10555)

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Course Description

Welcome to Florida Advanced Building Code, Fifth Edition- Energy Conservation & Electrical.

This course will provide a comprehensive review of the Florida Building Code with respect to energy and electrical code requirements. The material will cover all aspects of the code including the scope, intent, and covered applications. Design criteria involved in energy and electrical aspects of building construction will be discussed. Due to the fact that the Florida Building Code covers new construction as well as existing buildings, requirements for both types of construction will be reviewed.

Also, many specific applications are covered in the code, such as:

- Recessed lighting
- Light fixtures
- Accent lighting
- Lighting controls
- Programmable thermostats
- Smoke detectors/alarms
- Appliances
- Pool Heaters/Pumps, and
- Grounding

These applications, with respect to energy and electrical, will be covered in this course, providing a comprehensive review.

Learning Objectives

At the conclusion of this course, you will be able to:

- Recall the history and background of the Florida Building Code, as well as the current version and anticipated updates in progress
- Identify the main purpose of the Florida Building Code
- Define and describe the terms and specific applications in the area of energy and electrical that are covered by the Florida Building Code
- Recognize the code requirements and exceptions in the areas of energy and electrical and how to apply them to specific construction projects
- List the different requirements for new construction and existing buildings when applying the Florida Building Code

Introduction to Florida Building Codes

Prior to the 1970's, for the most part, local governments in the state of Florida had their own individual building code, and their code applied to that specific geographic jurisdiction. Some local governments adopted the Southern Standard Building Code, along with some modifications, as required to suit local conditions.

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The building codes in Florida were occasionally more stringent and tighter in some specific areas, primarily due to the potential for major hurricane events.

In the 1970's, the State of Florida started mandating statewide building codes, and had a stipulation that all local governments throughout the state adopted and enforced one of the four state-recognized model building codes known as the "state minimum building codes". This was done in conjunction with the rise in construction activity that was taking place at that time in the State of Florida.

Then, in the 1990's, a series of critical events involving natural disasters resulted in holding a comprehensive review of the building code system used in the State of Florida. Other factors were also involved that contributed to this need for a comprehensive review, including the increasing complexity of the building construction regulations, and vast changes in the markets. It was seen that the failure of the building codes resulted in devastation to lives and economies, as well as a statewide property insurance crisis. As a result, a call for reform took place in the state building construction regulatory system, and included a need to emphasize uniformity and accountability.

In 1998, the Florida state legislature made an amendment to Florida law to create a single state building code to be enforced by local governments.

Effective March 1st, 2002, the Florida Building Code superseded all local building codes (except for the Epcot Code). This new building code was developed by the Florida Building Commission, and the commission was also to be responsible for the maintenance of the code. The Florida Building Code is updated every three years and may be amended annually to incorporate interpretations and clarifications.

The basis for the Florida Building Code is the national model building codes and national consensus standards. These codes and standards are amended as necessary for the specific needs within the state of Florida itself. The code incorporates all regulations for construction that are building related, public or private, in the State of Florida, unless exempted in specific sections of the Florida statutes. The code is also presented in harmony with the Florida Fire Prevention Code in order to establish a unified and consistent standard for construction work to follow.

The code is made up of nine main volumes:

- Florida Building Code, Building- including state regulations for licensed facilities
- Florida Building Code, Plumbing
- Florida Building Code, Mechanical
- Florida Building Code, Fuel Gas
- Florida Building Code, Existing Building
- Florida Building Code, Residential
- Florida Building Code, Energy Conservation
- Florida Building Code, Accessibility, and
- Florida Building Code, Test Protocols for High Velocity Hurricane Zones

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Note, Chapter 27 of the Florida Building Code, Building, adopts the National Electrical Code, NFPA 70, by referencing the document.

Local governments are allowed to amend the requirements of the Florida Building Code, as long as the amendment is more stringent than the actual code requirements, and certain strictly defined conditions are met. Also, these amendments must be adopted through local ordinances and reported to the Florida Building Commission, at which point they are published on the code's website- www.floridabuilding.org, using legislative format. Local technical amendments may not go into effect until posted (online) by the Commission, for 30 days.. This review period is to allow substantially affected parties the time to file an appeal.

The Florida Building Code is adopted and updated with new editions on a triennial basis by the Florida Building Commission. The base codes are specified by Florida Statute and are the latest editions of the International Codes and the NEC. Versions of the Florida Building Code are available on the Building Commission's website (www.floridabuilding.org) for review along with downloadable supplements. Various supplements are also available on the website for information. Amendments to the code may be made annually in order to incorporate into the code any interpretations, clarifications, and to update the standards. This provides an opportunity to incorporate proposed changes from industry and other interested parties, as well as to correct conflicts and omissions that have been discovered in the code.

Minimum requirements for permitting, plan reviews and inspections are established by the code. Local jurisdictions are allowed to adopt additional administrative requirements, as long as they're more stringent.

Eleven Technical Advisory Committees (TAC's) review proposed code changes and clarifications of the code and make recommendations to the Commission. TAC's membership follows ANSI American National Standards Institute guidelines and includes:

- Accessibility
- Joint Building Fire
- Building Structural
- Code Administration/Enforcement
- Electrical
- Mechanical
- Plumbing and Fuel Gas
- Roofing
- Special Occupancy
- Swimming Pool

Questions regarding how the Florida Building Code applies to a specific project are first directed to the local building official, or other local authority having jurisdiction where the project is located. The Florida Building Commission website, www.floridabuilding.org provides additional information on subject areas covered by the Florida building codes, development process, and points of contact.

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Building permits are required by the Florida Building Code, and applications are made to the building official to obtain the required permit. The code stipulates the types of projects that will be covered by the code to ensure that all applicable work is captured through the code review process and the building code can be properly enforced. The code accomplishes this through the following terminology applying to the building permit application: “This applies to all cases where the owner or authorized agent intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert, or replace any impact resistant coverings, electrical, gas, mechanical or plumbing system, the installation of which is regulated by the code, or to cause any such work to be done.”

The NFPA 70 National Electrical Code is the adopted standard used by the Florida Building Code. The adopted version is 2008 NEC National Electrical Code, although a 2014 version has been published. Florida Building Code Section 102.4 states that “where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.” This means the Florida Building Code overrides the NEC code.

For the balance of this course on the Florida Building Code (FBC) - Energy Conservation and Electrical, reference sections will be included for your convenience in cross referencing the course material with the appropriate code sections. This is intended to help you quickly refer to the code and understand the application of each individual section as it applies to energy conservation and electrical disciplines.

Florida Building Code – Energy Conservation

Administration & Design Criteria

Section 101.2, Scope.

This section states that the code applies to residential and commercial buildings. Also, it is a statewide uniform code and shall not be made more stringent or lenient by local code.

Section 101.3, Intent.

This section states that the code shall regulate the design and construction of buildings, and that the intent is for the effective use of energy. Also, the code is flexible in applying innovative approaches and techniques to achieve the effective use of energy. Safety, health and environmental requirements are not bypassed and these requirements will be met according to the applicable codes or ordinances that they are covered by.

Section 101.4, Applicability.

The code states that where, in any specific case, different sections of the code specifies different materials, methods of construction or other requirements, the most restrictive shall

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govern. Also, where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

Section 101.4.7, Building Systems.

This section covers thermal efficiency standards, and exceptions, for building systems where new products are installed, or where replacement of an entire HVAC system is required in an existing building and where a permit must be obtained.

Thermal efficiency is a measure of performance for a device that uses thermal energy, and indicates how well energy is converted by the device. In general, the efficiency for a device that converts energy is the ratio between the useful output of a device and the input, in energy terms. For example, a gasoline engine operates at approximately 25% efficiency. Coal fired power plants operate at about 45% thermal efficiency.

The code requires that minimum efficiencies be provided for new products for the following systems:

- Heating, ventilating, or air conditioning systems
- Service water or pool heating systems
- Electrical systems and motors, and
- Lighting systems

The code includes several exceptions, including:

- Where part of a functional unit is repaired or replaced. The example given in the code is that replacement of an entire HVAC system is not required because a new compressor or other part does not meet code when installed with an older system. In this case, the new compressor will typically meet all current code requirements, but only adding a new compressor will not improve the entire system. As a result, the entire system is not up to code, but the code allows this situation as an exception.

The outdoor and indoor units must meet USDOE certification requirements and they must match. Evidence that they are matched units must be verified by specified means.

- Where existing components are planned to be used with a replacement system. Examples include air distribution ducts or electrical wiring for light fixtures. These types of components would not need to meet code if it would require their replacement to meet code
- Replacement equipment, such as PTAC's packaged terminal air conditioners (self-contained heating and air conditioning system) are an exception where they would require extensive revisions to other systems, equipment, or elements of a building where such replacement is a like-for-like replacement.

Section 303.2.3, Recessed Equipment.

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This section requires that lighting fixtures; heating, ventilating, and air conditioning equipment; and other equipment shall not be recessed in such a manner as to affect the insulation thickness. This applies to wall heaters, ducts and plenums.

Exceptions to this requirement are provided, including:

- Total combined area affected is less than one percent of the assembly's opaque area
- The entire roof, wall, or floor is covered with insulation to the full depth required
- The effects of reduced insulation are included in calculations using an area weighted average method and compressed insulation values obtained from Table 303.2.1 in the code.

In all cases, air leakage through or around the recessed equipment to the conditioned space shall be limited in accordance with Sections 402.4.5 or 502.3.8 of the code, as applicable.

Overall, this section of the code frequently results in the requirement that recessed equipment be caulked and sealed adequately and preventing infiltration.

Residential Energy Efficiency

Section 402.4.5, Recessed lighting.

This section requires that recessed luminaires installed within the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. It also states that all recessed luminaires shall be IC-rated and labeled as meeting ASTM E283. Additional requirement stated is that all recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering. The code states that all recessed luminaires installed in the building thermal envelope are required to be IC-rated and labeled as meeting ASTM E 283 (IC stands for Insulated Contact).

An IC rated fixture must be approved for zero clearance insulation cover by a nationally recognized testing laboratory or other nationally recognized entity. ASTM E283 is a standard ASTM test method for determining the rate of air leakage through exterior windows, walls, and doors under specified pressure. This test method is required for recessed lighting fixtures and establishes the pressure and allowable leakage cubic feet per minute of air flow through the fixture.

Section 403.1.1, Programmable Thermostat.

This section covers the requirements for programmable thermostats and requires that at least one thermostat per dwelling unit be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This applies to when the primary heating system is a forced-air furnace. The thermostat required by this section shall include the capability of setting back or temporarily operating the system to maintain zone temperatures down to 55°F or up to 85°F. Also, the thermostat is to be initially programmed with a heating temperature set point no higher than 70°F and a cooling temperature set point no lower than 78°F.

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Also included in this section is a requirement relating to controls for heat pump supplemental heat.

§403.1.2 states that heat pumps that are equipped to provide supplementary electric-resistant heat shall have controls that prevent the supplemental heat operation when the heat pump compressor itself can meet the heating load. An exception is noted regarding the defrost period of operation.

§403.1.3 requires if humidistat is provided with the system for comfort dehumidification, it shall be capable of being set to prevent the use of fossil fuel or electricity to reduce humidity below 60% relative humidity.

Section 403.9.1, Pool and Spa Heaters.

The code requires that all pool heaters be equipped with a readily accessible on-off switch that is mounted outside the heater to allow shutting off the heater without adjusting the thermostat setting.

Gas and oil-fired pool and spa heaters are covered and are required to have a minimum thermal efficiency of 78% (manufactured on or before April 16, 2013), or 82% (after April 16, 2013).

Heat pump pool heaters are also covered by this section of the code and are required to have a minimum COP of 4.0. COP is coefficient of performance and is the ratio of cooling or heating to energy consumption and can be expressed as Useful energy transferred to a system per hour divided by energy applied to the system per hour. For example, a refrigerator with a COP of 2.0 moves 2 watts of heat for every watt of electricity consumed. An air conditioner with a COP of 4.0 moves 4 watts of heat for every watt consumed. For heaters, as in this code section, a heater with a COP of 4.0 produces 4 watts of heat with each watt of power consumed.

Section 403.9.2, Time Switches.

Time switches are required by the code to control swimming pool heaters and pumps that will automatically turn the heaters and pumps on and off according to a preset schedule. A time switch is operated by a timing mechanism. The switch can be connected to a circuit operating from main power, or for lower voltage circuits.

The code includes several exceptions listed in this section:

- Where public health standards require 24-hour pump operation
- Where pumps are required to operate solar- and waste-heat-recovery pool heating systems
- Where pumps are powered exclusively from on-site renewable generation

Section 403.9.4, Residential pool pumps and pump motors.

This section covers pool filtration pumps and pump motors and provides several requirements for this equipment.

- Split phase, shaded pole or capacitor start induction run type motors are not permitted.
- Pool pumps and motors with a total horsepower of 1 horsepower or greater are required to be equipped to operate with 2 or more speeds.
- Pool pump motors will be capable of operating the pump at a minimum of 2 speeds

Section 403.9.5, Portable spa standby power.

The code specifies the maximum standby power for portable electric spas, based on the spa total volume and meeting test protocols established by the spa industry. The standby power for a portable spa shall not be greater than a value calculated as 5 x 67% of the spa volume in gallons.

Section 404.1, Lighting equipment.

A minimum of 50% of the lamps in permanently installed lighting fixtures shall be high efficacy lamps, as required by this section of the code.

A lamp is simply the light bulb or tube itself; it is not the fixture. A chandelier is one fixture but may have multiple lamps. Energy consumed for lighting has been a key focus for the International Code Council (ICC) and the council included this 50% requirement in the 2009 Energy Conservation Code and the 2009 Residential Code. ICC and FBCEC defines high efficacy as 60 lumens per watt for lamps over 40 watts, 50 lumens per watt for lamps over 15 watts to 40 watts, and 40 lumens per watt for lamps 15 watts or less. These efficacy minimums are above the level of many current incandescent products. However, many compact fluorescent lamps, all T-8 or smaller diameter linear fluorescent lamps, and most metal halide lamps meet these requirements.

Commercial Energy Efficiency

Section 503.2.3, HVAC equipment performance requirements.

Several tables are provided in this section for performance requirements related to HVAC equipment. These tables cover Unitary Air Conditioners, Heat Pumps, Packaged Terminal Air Conditioners (PTAC), Warm Air Furnaces, Boilers, Condensing Units, and Water Chilling Packages.

The efficiencies that are provided in these tables must be verified through certification procedures and under an approved certification program. The test procedures listed in the code are from the AHRI, the Air Conditioning, Heating and Refrigeration Institute. AHRI is a globally recognized certification program and is respected throughout the construction and equipment manufacturer's industry.

In cases where a certification program does not exist, it is required that the manufacturer provide supporting data related to efficiency ratings. If multiple rating conditions or performance requirements are provided, the equipment must satisfy all stated requirements. Also, where components from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements stated in the code. The code provides an example for multiple rating conditions that is common- indoor or outdoor coils.

Among other types of values, minimum efficiencies are provided in the tables in this section in SEER values. SEER is Seasonal Energy Efficiency Ratio and is the rating provided by AHRI to express the performance rating of unitary air conditioning and air source heat pump equipment. (It should be noted that in some cases, such as units less than 65,000 Btu/h, the SEER values are set by NAECA.)

The SEER rating of a unit is the cooling output during a typical cooling season divided by the total electric energy input during the same period. The higher the SEER rating, the more energy efficient it is. The units are BTU's of cooling divided by the watt-hours of energy consumed.

The tables also refer to EER values and COP values. EER is Energy Efficiency Ratio of a particular cooling device and is the ratio of output cooling (BTU/hr) to input electrical power (watts). The EER is considered a more realistic measurement of energy in warmer climates due to the high demand and higher cost of peak hour electricity.

EER is related to COP, the coefficient of performance, with the primary difference being that the COP of a cooling device is unit-less, because the numerator and denominator are expressed in the same units. EER requires converting from BTU/hr to watts (x 3.412).

Typical values provided in the tables area:

- Air Cooled Air Conditioner, split system or single package- 13.0 SEER
- Through the wall, air cooled air conditioner, split system or single package- 12.0 SEER
- Air Cooled Heat Pumps, split system or single package- 13.0 SEER

Section 504.7, Pools.

This section of the code states that all pools shall be provided with energy conserving measures and specifies requirements for pool heaters and time switches. All pool heaters shall meet minimum efficiencies as listed in the table provided for efficiencies and be equipped with a readily accessible on-off switch that is mounted outside the heater to allow shutting off the heater without adjusting the thermostat setting. "Readily accessible" means capable of being reached quickly for operation, renewal, or inspection without the person needing access to climb over or remove obstacles, or to be forced to use portable ladders or other equipment.

Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

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Time switches are required on swimming pool heaters and pumps. These switches automatically turn on and off the heaters and pumps according to a preset schedule. The following exceptions are provided in the code:

- Where public health standards require 24-hour pump operation, or
- Where pumps are required to operate solar-and-waste-heat-recovery pool heating systems.

Electrical Power and Lighting Systems

Section 505.1, General.

This section covers lighting system controls, the connection of ballasts, and the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications. These systems include building facades, illuminated roofs, architectural features, entrances, exits, loading docks, and illuminated canopies; and exterior building grounds lighting.

There are several exceptions that are covered in the code where this section would not apply, including:

- Lighting within dwelling units where at least 50% of the permanently installed interior light fixtures are equipped with high efficacy lamps
- Emergency lighting that is automatically off during normal building operation
- Lighting that is specifically designated as required by a health or life safety regulation
- Decorative gas lighting systems

Section 505.2. Lighting controls.

The code provides several lighting controls requirements. For interior lighting systems, each area enclosed by walls or floor-to-ceiling partitions shall have at least one control device to independently control the general lighting within the space. Each manual device shall be readily accessible and located so the occupants can see the controlled lighting. An exception to this requirement is when there is a remote location for safety reasons and the remote control device has an indicator pilot light as part of or next to the control device. Also, the light must be clearly labeled to identify the appropriate controlled lighting system.

For classrooms and meeting rooms, the code requires that a control device be installed in the classroom, conference/meeting room, and employees lunch and break rooms that will automatically turn off the lighting within 30 minutes of all occupants having left the space. Also, these spaces are not required to be connected to other automatic lighting shutoff controls.

Exceptions to these requirements include:

- Shop classrooms

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- Laboratory classrooms
- Preschool through 12th grade classrooms

For all other spaces, the code states that each control device shall be activated either manually by the occupant, or automatically by sensing the occupant and be capable of overriding any time-of-day shut-off control for no more than four hours.

Additional controls are noted in this section and include:

- Display or accent lighting. Display or accent lighting shall have a separate control.
- Case lighting. Lighting in cases used for display purposes shall have a separate control.
- Sleeping unit controls. Sleeping units in hotels, motels, and boarding houses shall have at least one master switch at the main entry door that controls all permanently wired luminaires and switched receptacles, except those in the bathroom.
- Task lighting. Supplemental task lighting shall have a control device that is integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting. This applies to under shelf and under cabinet lighting.
- Non-visual lighting. Lighting for non-visual applications, such as for plant growth and food warming. These items shall have a separate control device. And lastly,
- Demonstration lighting. Lighting equipment that is for sale or for demonstrations shall have a separate control device.

Automatic lighting shutoff features are required for buildings larger than 5000 sq. ft. area and the lighting control shall function on either:

- A scheduled basis, using time of day, with an independent program schedule that controls the interior lighting for areas not exceeding 25,000 sq. ft and are not more than one floor.
- An occupant sensor that shall turn lighting off within 30 minutes of the occupant leaving the space.
- A signal from another control or alarm system that indicates the area is unoccupied.

There are also exceptions provided where automatic control devices are not required:

- Sleeping units
- Lighting intended for 24 hr. operation
- Lighting in spaces where patient care is directly provided

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- Spaces where an automatic shutoff would endanger occupant safety or security.

Occupant overrides are also covered in the code. Where an automatic time switch control device is installed, it shall incorporate an override switching device with the following requirements. It must be:

- Readily accessible
- Located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated.
- Manually operated by an occupant or automatically by sensing an occupant.

Holiday Scheduling is included in the code. If an automatic time switch control is installed, it shall incorporate an automatic holiday scheduling feature that turns off all loads for at least 24 hours, and then resumes the normally scheduled operation. This 24 hour off period would work with a single day holiday period. Exceptions are allowed for holiday scheduling, including retail stores, malls, restaurants, grocery stores, places of religious worship, and theaters.

Daylight zones shall be provided with individual controls that control the lights independent of general area lighting. Requirements are provided for controls based on the facing direction of the zones and proximity to skylights.

Exterior lighting requires controls that will turn off the exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours. Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination of photo sensor and a time switch, or an astronomical time switch. An astronomical time switch is a programmable switch to turn on electric utilities between sunset and sunrise according to the geographic area that it is located.

Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photo sensor. All time switches shall be capable of retaining programming and the time setting if a loss of power occurs for at least a 10 hour period.

An exception to the requirement for the astronomical time switch is lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

Section 505.3. Tandem Wiring (Mandatory).

Luminaires designed for use with one or three linear fluorescent lamps greater than the 30 watt size each shall be tandem wired when two or more luminaires are provided in the same space and on the same control device. Tandem wiring is where the ballast in one fixture lights a lamp in the adjoining fixture. This method allows the more energy efficient two lamp ballasts to be used with a group of three lamp fixtures.

Several exceptions to the tandem wiring requirement is provided in the code:

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- Recessed luminaires more than 10 ft apart measured center to center
- Surface mounted or pendant luminaires that are not continuous, and
- Luminaires using three lamp high frequency electronic or three lamp electromagnetic ballasts

Section 505.4. Exit signs (Mandatory).

This section states that exit signs that are internally illuminated shall not exceed 5 watts per side.

Section 505.5. Interior lighting power requirements (Prescriptive).

This section is noted as “Prescriptive”. Codes generally have prescriptive and performance paths for compliance. Prescriptive paths are easy-to-use tables that contain required minimum or maximum values. Performance paths are used to trade one energy saving measure for another. For instance, if the wall insulation does not meet the prescriptive requirements, but the ceiling insulation exceeds the prescriptive requirements, then using a performance method may show compliance of the whole building with the code. Prescriptive paths are commonly used for typical buildings in states with newly adopted codes. Once designers become familiar with performance software, these become more popular. Some performance methods can be used to show energy savings beyond code, and are used for sustainability programs or state tax credits.

The total connected interior lighting power in watts is required to be the sum of the watts from all interior lighting equipment. However, there are the following exceptions included in the code:

- The connected power associated with lighting equipment from the following is not included in calculating total connected lighting power for:
 - Professional sports arena playing field lighting
 - Sleeping unit lighting in hotels, motels, boarding houses, or similar buildings
 - Emergency lighting automatically off during normal building operation
 - Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired and other medical and age-related issues
 - Lighting in interior spaces that have been specifically designated as a registered interior historic landmark
 - Casino gaming areas

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Several additional exceptions are provided in the code in Sect. 505.5.2, including controls requirements. Refer to this section of the code for additional information.

Section 505 also includes requirements for Luminaire wattage (505.5.2.5). This section includes criteria for incandescent, tungsten-halogen, line-voltage lighting tracks, and other miscellaneous lighting equipment. Refer to this section of the code for additional information.

Charts are also provided in this section for Interior Lighting Power. The total interior lighting power in watts is required to be the sum of all interior lighting powers for all areas in the building covered in the permit. The area is defined as all contiguous spaces that accommodate or are associated with a single building area type. Typical lighting power densities (LPD) in watts per square foot are:

- Office- 1.1 watts per square foot
- Conference Room- 1.3 watts per square foot
- Workshop- 1.9 watts per square foot
- Physical therapy- 0.9 watts per square foot
- Equipment Room- 1.2 watts per square foot
- Parking garage- 0.2 watts per square foot, and
- Airport concourse- 0.6 watts per square foot

Section 505.6, Exterior lighting (Mandatory).

This section of the code applies to all exterior lighting, except low voltage landscape lighting. Other exceptions take into account historical, safety, signage and emergency considerations.

The code provides an allowance for the total exterior lighting power for all exterior building applications and is equal to the sum of a base site allowance plus individual allowances for areas that are to be illuminated. The values for individual allowances are provided in Table 505.6.2(1) and are based on specific lighting zones- 1 through 4. Lighting zones are characterized as follows:

- Zone 1- developed areas of national parks, state parks, forest land and rural areas
- Zone 2- areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
- Zone 3- all other areas, and
- Zone 4- High activity commercial districts in major metropolitan areas as assigned by the local land use planning authority

Several exceptions are noted for exterior applications that are exempt when equipped with a control device independent of the control of the nonexempt lighting. Some of the exceptions include:

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- Specialized signal, directional and marker lighting associated with transportation
- Advertising signage or directional signage
- Integral to equipment or instrumentation and is installed by its manufacturer
- Theatrical purposes, including performance, stage, film production and video production
- Athletic playing fields
- Temporary lighting

Exterior lighting allowances are also presented as tradable and non-tradable surfaces. Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoors sales areas may be traded. For non-tradable surfaces, lighting power density calculations for these applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting (Table 505.6.2(2)).

Section 505.7, Electrical power (Mandatory).

Electrical distribution provisions in the code applies to all building power distribution systems and are subject to the Florida Public Service Commission rules regarding electric utilities found in the Florida Administrative Code, and the design conditions in ASHRAE Standard 90.1

ASHRAE Standard 90.1 provides the minimum requirements for the energy-efficient design of most buildings and offers, in detail, the minimum energy-efficient requirements for the design and construction of new buildings and their systems, new portions of buildings and their systems, and new systems and equipment in existing buildings as well as the criteria for determining compliance with these requirements.

Electrical metering is required in buildings having individual dwelling units. Electrical meters are used to determine the electrical energy consumed by each tenant by separately metering the individual dwelling units.

Requirements for maximum voltage drop are also included in this section, including a maximum voltage drop of 2% of design load for sizing of feeder and customer owned service conductors. Also, for branch circuits, branch circuit conductors shall be sized for a max voltage drop of 3% at design load.

Florida Building Code – Building

Swimming Pools & Bathing Places

Section 424.1.4, Electrical systems.

This section of the code covers electrical systems for public swimming pools and bathing places. The main stipulation is provided that Chapter 27 of the Building section of the Florida Building Code must be adhered to. In addition, FBC-B Chapter 27 adopts the NEC.

Artificial lighting is required at all swimming pools that are planned to be used at night or which do not have adequate natural lighting. This amount of light is determined by all portions of the pool, including the bottom, needing to be readily seen without glare.

For outdoor pool lighting, lighting is required to provide a minimum level of 3 footcandle (30 lux) of illumination at the pool water surface and the pool wet deck surface. Underwater lighting is required to be at a minimum of $\frac{1}{2}$ watt per square foot of pool surface area.

Footcandle, lumen and lux are terms for luminance that are used in the code. Illuminance is a measure of the amount of light falling on a surface. It is defined as the density of the luminous flux incident on a surface. One footcandle is the luminance at a point on a surface which is one foot from, and perpendicular to, a uniform point source of one candela. One lux is the luminance at the same point at a distance of 1 meter from the source. One lumen uniformly distributed over one square foot of surface provides an illumination of 1 footcandle.

For indoor pool lighting, lighting is required to provide a minimum of 10 footcandle of illumination at the pool water surface and the pool wet deck surface. Underwater lighting is required to be at a minimum of $\frac{8}{10}$ watt per square foot of pool surface area.

There are also requirements stated for underwater lighting to use transformers and low voltage circuits with each underwater light fixture being grounded. Maximum voltage for each light fixture is 15 volts and the maximum incandescent lamp size is 300 watts. Wading pools are exempt from underwater lighting requirements. However, they must have overhead lighting of 10 foot-candles if indoors or 6 foot-candles for outdoor night use. Such illumination shall be provided over the pool water surface and the pool deck surface.

Locations for underwater lights are also specified. These lights shall be arranged in a way that the underwater illumination is as uniform as possible and shall not be less than 18 inches below the normal operating water level. Underwater lighting requirements may be waived in some cases if the overhead lighting provides at least 15 footcandle (150 lux) of illumination at the pool water surface and the pool wet deck surface.

Overhead electrical service wiring is not allowed to pass within an area extending a distance of 10 feet horizontally away from the inside edge of the pool walls, diving structures, observation stands, towers or platforms. The code states that allowances for overhead conductor clearances to pools may meet the safety standards included in NEC (National Electrical Code) instead of the FBC requirements. Chapter 27 for electrical requirements included in the FBC Building section of the code are also referenced and required to be met.

Fire Protection Systems

For new construction, the code states that required smoke alarms shall receive their primary power from the building wiring where this wiring is served from a commercial source and shall be equipped with a battery backup. Also, smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for over current protection.

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An exception is noted in the code as follows: Smoke alarms are not required to be equipped with a battery backup system where the smoke alarms are connected to an emergency electrical system.

For wiring to auxiliary devices and equipment used for fire extinguishing systems, the code requires adherence to NFPA 72 regarding monitoring for integrity. NFPA 72 is also referenced in regards to primary and secondary power supplies for fire alarm systems.

Section 911, Fire Command Centers.

Chapter 9 includes requirements for fire command centers, where required by other sections of the code and in all buildings classified as high-rise buildings. The local fire chief is required to approve the location and accessibility of the fire command center. The location shall be separated from the remainder of the building by not less than a 1 hr. fire barrier. The barrier is required to be constructed in accordance with Section 707.1 for vertical assemblies and Section 707.2 for horizontal assemblies, or both, as appropriate. The fire command center room shall be a minimum of 200 square feet with a minimum dimension of 10 feet.

The main features of the fire command center are stipulated by the code and in compliance with NFPA 72. They are:

- The emergency voice/alarm communication system control unit
- The fire department communications system
- Fire detection and alarm system annunciator
- Annunciator unit visually indicating the location of elevators
- Status indicators and controls for air distribution systems
- The fire fighters control panel
- Controls for unlocking stairwell doors simultaneously

Section 916, Carbon monoxide protection.

An operational carbon monoxide alarm must be installed within 10 feet of each room used for sleeping purposes in a new building or addition. This applies to every separate building or an addition to an existing building that has a fossil-fuel-burning heater or appliance, a fireplace, an attached garage, or other feature, fixture or element that emits carbon monoxide as a byproduct of combustion.

The code requires one of the following for a carbon monoxide alarm:

- A hard-wired carbon monoxide alarm
- A battery-powered carbon monoxide alarm
- A hard-wired combination carbon monoxide and smoke alarm
- A battery-powered combination carbon monoxide and smoke alarm

Electrical

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Chapter 27 of the Florida Building Code- Building governs the electrical components, equipment and systems used in buildings and structures covered by the code. The code also references the NFPA 70, National Electrical Code for all electrical components, equipment and systems to be designed and constructed according to the NEC.

Section 2702, Emergency and Standby Power Systems.

Emergency and standby power systems are also referenced to the NFPA 70 National Electrical Code; NFPA 110, Standard for Emergency and Standby Power Systems; and NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems for adherence to installation requirements. In addition, a table is provided in the code for electrical requirements within the various volumes of the Florida Building Code. The cross reference tables include the following Florida Building Code sections:

- FBC Residential
- FBC Existing Building
- FBC Mechanical
- FBC Plumbing
- FBC Fuel Gas

Section 2704, Bonding Metal Framing Members.

The code includes requirements for metal framing members to be bonded to the equipment grounding conductor for the circuit that may energize the framing. This conductor must be sized in accordance with NEC. For this section, a grounded metal outlet box attached to the framing is permitted.

Special Construction

Section 3112, Lighting, Mirrors, Landscaping.

This section of the code states that adequate lighting is to be provided for automated teller machines (ATM's) during the hours of darkness with respect to an open and operating automated teller machine and any defined parking area, access area and the exterior of an enclosed automated teller machine installation. The following requirements for this lighting are provided:

- There shall be a minimum of 10 footcandle power at the face of the automated teller machine and extending in an unobstructed direction outward 5 feet
- There shall be a minimum of 2 footcandle power within 50 feet in all unobstructed directions from the face of the automated teller machine. If the automated teller machine is located within 10 feet of the corner of the building and the automated teller machine is generally accessible from the adjacent side, there shall be a minimum of 2 footcandle power along the first 40 unobstructed feet of the adjacent side of the building.

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- There shall be a minimum of 2 footcandle power in that portion of the defined parking area within 60 feet of the automated teller machine.

Florida Building Code – Residential

Mechanical

Section M1305, Appliance Access.

The code provides this section to address adequate access to appliances for inspection, service, repairs and replacement. The electrical requirements section for attic installations covers luminaires and states that for a luminaire controlled by a switch located at a required passageway opening, a receptacle outlet shall be installed at or near the appliance location in accordance with Chapter 34 of the code.

Air handling units are also covered. Air handling units are allowed to be placed in attic areas if the following requirements are met:

- The service panel of the equipment is located within 6 feet of an attic access
- A device is installed to alert the owner or shut down the unit when the condensation drain is not working properly
- The attic access opening is of sufficient size to replace the air handler
- A notice is posted on the electric panel indicating to the homeowner that the air handler is located in the attic.

Fuel Gas

Section G2410, Electrical.

For grounding requirements, the code states that each above-ground portion of a gas piping system upstream from the equipment shutoff valve shall be electrically continuous and bonded to any grounding electrode. Reference is made to Chapter 34 of the Residential portion of the Florida Building Code- General Electrical requirements. This reference is also made with respect to electrical connections between appliances and the building wiring, including the grounding of the appliances.

Section G2411, Electrical Grounding.

Each above-ground portion of a gas piping system that is likely to become energized shall be electrically continuous and bonded to an effective ground fault current path. Gas piping shall be considered to be bonded where it is connected to appliances that are connected to the equipment grounding conductor of the circuit supplying that appliance.

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In the case of corrugated stainless steel tubing (CSST) gas piping systems, these systems shall be bonded to the electrical service grounding electrode system at the point where the gas service enters the building. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.

Part VII — Electrical, Chapter 34 General Requirements and Chapter 41 Swimming Pools Section 3402, Building Structure Protection.

This section covers the bonding of metal framing members. Metal framing members shall be bonded to the equipment grounding conductor for the circuit that may energize the framing. This bonding is required to be sized in accordance with NFPA 70 National Electrical Code (NEC), Table 250.122. A clarification is included that a grounded metal outlet box attached to the framing is permitted to be installed.

Section R4101.16, Electrical.

The swimming pools section of the code provides an electrical requirement section that refers to Chapter 27 of the Florida Building Code. Note, FBC-B Chapter 27 adopts the NEC.

Florida Building Code – Existing Buildings

Repairs

Section 507, Electrical.

Section 507 pertains to electrical repairs that are required in existing buildings. These repairs of electrical wiring and equipment shall be allowed, as long as repairs and replacements are made with like material in accordance with Chapter 27 of the Florida Building Code, Building.

For electrical receptacles, replacements shall also comply with the applicable requirements of Chapter 27 of the Florida Building Code, Building.

Edison type plug fuses shall be used for replacement work only where there is no evidence of over fusing or tampering. These requirements also must comply with Chapter 27 of the Florida Building Code, Building.

With regards to over fusing, fuses and circuit breakers within electrical panels limit the amount of current that can flow through the wires. Excess current will heat up the wires. When oversized fuses are installed, this overheating can occur. This might occur when someone installs a window air conditioner and plugs it into the general lighting circuit. If fuses repeatedly blow, people may tend to install a higher amperage fuse. With this type of fuse replacement, the fuse won't blow, but the wiring on the circuit will heat up excessively. This can be a frequent occurrence in older houses that are not supplied with an adequate number of individual circuits.

When replacing non-grounding type receptacles with grounding type receptacles, and when installing branch circuits that are not equipped with an equipment grounding conductor in the

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branch circuitry, the code states that a grounding conductor of a grounding type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system. Another option is to ground to any accessible point on the grounding electrode conductor. Any work of this nature is required to be completed in accordance with Chapter 27 of the Florida Building Code, Building.

For Group I-2 buildings per the Florida Building Code, non-hospital grade receptacles in patient bed locations shall be replaced with hospital grade receptacles. This work is to adhere to NFPA 99 as well as Chapter 27 of the Florida Building Code, Building.

NFPA 99 is the Health Care Facilities Code issued by NFPA. The Florida Building Code has adopted the 2005 edition although it is scheduled for the next edition in 2015. The edition of the referenced standards may not be the latest edition, but is the edition contained in the chapter listing referenced standards. Each volume of the Florida Building Code has its own chapter titled Referenced Standards. (e.g. FBC-EB Ch. 15, FBC-R Ch. 43, FBC-B Ch. 35).

NFPA 99 establishes criteria for levels of health care services or systems based on risk to the patients, staff, or visitors in health care facilities to minimize the hazards of fire, explosion, and electricity. Requirements included in NFPA 99 address installation, inspection, testing, maintenance, performance, and safe practices for facilities, material, equipment, and appliances, including medical gas and vacuum systems.

The repairs section of this code also addresses grounding of appliances. The frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers and outlet or junction boxes that are part of the existing branch circuit for these appliances are permitted to be grounded to the grounded circuit conductor. Chapter 27 of the Florida Building Code, Building, shall be followed.

Alterations Level 1

Florida Building Code refers to Level 1 and Level 2 Alterations. Level 1 applies for projects involving removal and replacement, or covering of existing materials, equipment, fixtures using new materials that serve the same purpose. Level 1 does not include reconfigurations of spaces. Level 2 covers reconfiguration of spaces, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of an additional system. Reconfiguration of space includes work that removes or installs walls and could alter the path of egress.

Section 608, Electrical.

For R-3 Residential Occupancies, this section also states that existing electrical wiring and equipment undergoing repairs shall be permitted to be repaired or replaced with like material.

For replacement of non-grounding type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding type receptacle is allowed to be grounded to any accessible

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point on the grounding electrode system or to any accessible point on the grounding electrode conductor.

This section of the code for this type of occupancies also includes the requirements for grounding of appliances. The frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers and outlet or junction boxes that are part of the existing branch circuit for these appliances are permitted to be grounded to the grounded circuit conductor. Chapter 27 of the Florida Building Code, Building, shall be followed.

Alterations Level 2

Section 708, Electrical.

This section includes requirements for new installations. Any newly installed electrical equipment and wiring related to work done in any work area shall comply with the materials and methods requirements in Chapter 27 of the Florida Building Code, Building.

For existing installations, the code requires existing wiring in work areas in the following occupancy groups to be upgraded to meet the requirements of Chapter 27 of the Florida Building Code, Building:

- Group A-1
- Group A-2
- Group A-5
- Group H
- Group I

In cases of residential occupancies, Groups R-2, R-3 and R-4, the following requirements shall be met:

- All enclosed areas, other than closets, kitchens, basements, garages, hallways, laundry areas, utility areas, storage areas, and bathrooms are required to have a minimum of two duplex receptacle outlets or one duplex receptacle outlet and one ceiling or wall-type lighting outlet.
- For kitchen areas, a minimum of two duplex receptacles are required.
- Laundry areas are required to have a minimum of one duplex receptacle outlet located near the laundry equipment.
- A minimum of one lighting outlet is required for every bathroom, hallway, stairway, attached garage, and detached garage provided with electric power, and to illuminate outdoor entrances and exits.
- A minimum of one lighting outlet is required in utility rooms and basements where the space is used for storage or containment of equipment requiring service.

Change of Occupancy

Section 908, Electrical – Special Occupancies

This section of the code covers situations where the occupancy of an existing building or part of an existing building is changed to one of the following special occupancies:

- Hazardous locations
- Commercial garages, repair, and storage
- Aircraft hangars
- Gasoline dispensing and service stations
- Bulk storage plants
- Spray application, dipping and coating processes
- Health care facilities
- Places of assembly
- Theaters, audience areas of motion picture and television studios, and similar locations
- Motion picture and television studios, and similar locations
- Motion picture projectors
- Agricultural buildings

Electrical wiring and equipment in any of the above special occupancies is required to comply with the applicable requirements of Chapter 27 of the Florida Building Code, Building. This requirement is independent of whether or not there is a change of occupancy group.

Where the occupancy of an existing building or part of an existing building is changed, all unsafe conditions are required to be corrected without requiring that all parts of the electrical system be brought up to the current edition of Chapter 27 of the Florida Building Code, Building.

Where the occupancy of an existing building or part of an existing building is changed, electrical service shall be upgraded to meet the requirements of Chapter 27 of the Florida Building Code, Building.

Where the occupancy of an existing building or part of an existing building is changed, the number of electrical outlets shall comply with Chapter 27 of the Florida Building Code, Building.

Conclusion

Summary

Building codes are sets of rules that specify the minimum acceptable level of safety for constructed objects – buildings and non-building structures. This course has covered one of those building codes - the Florida Building Code. The main purpose of building codes are to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures.

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The Florida Building Code is applied by architects, engineers, and construction companies, but is also used for various purposes by safety inspectors, real estate developers, manufacturers of building products and materials, insurance companies, facility managers, and others.

This course has reviewed the key elements in the area of Energy Conservation and Electrical as part of the Volumes and Chapters of the Florida Building Code.

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Resources

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Author Biography

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Jim Taube holds a BS degree in Civil and Environmental Engineering from Clarkson University in Potsdam, NY. He is a registered Professional Engineer in the state of Ohio. Jim worked at primary paper mill locations in the pulp and paper industry for 23 years providing capital project management and engineering, maintenance and utilities management. He has worked in consulting engineering since 1999 in the retail and commercial building construction area. Jim's positions have included project mechanical and electrical design, overall project management and construction administration. Typical projects he has been responsible for include retail buildings, big box retail, commercial offices, medical science laboratories, and institutional/educational facilities. In addition to his professional engineering registration, Jim possesses the Certified Energy Manager certification (CEM) from the Association of Energy Engineers. Jim is married, has 4 grown children, and lives in Middletown, Ohio north of Cincinnati.