

Conducting Residential Electrical Inspections

PART I: DWELLING UNIT ROUGH WIRING AND TEMPORARY SERVICE INSPECTIONS

NFPA Electrical Inspectors Section

nfpa.org/electricalinspectors

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**NATIONAL FIRE
PROTECTION ASSOCIATION**

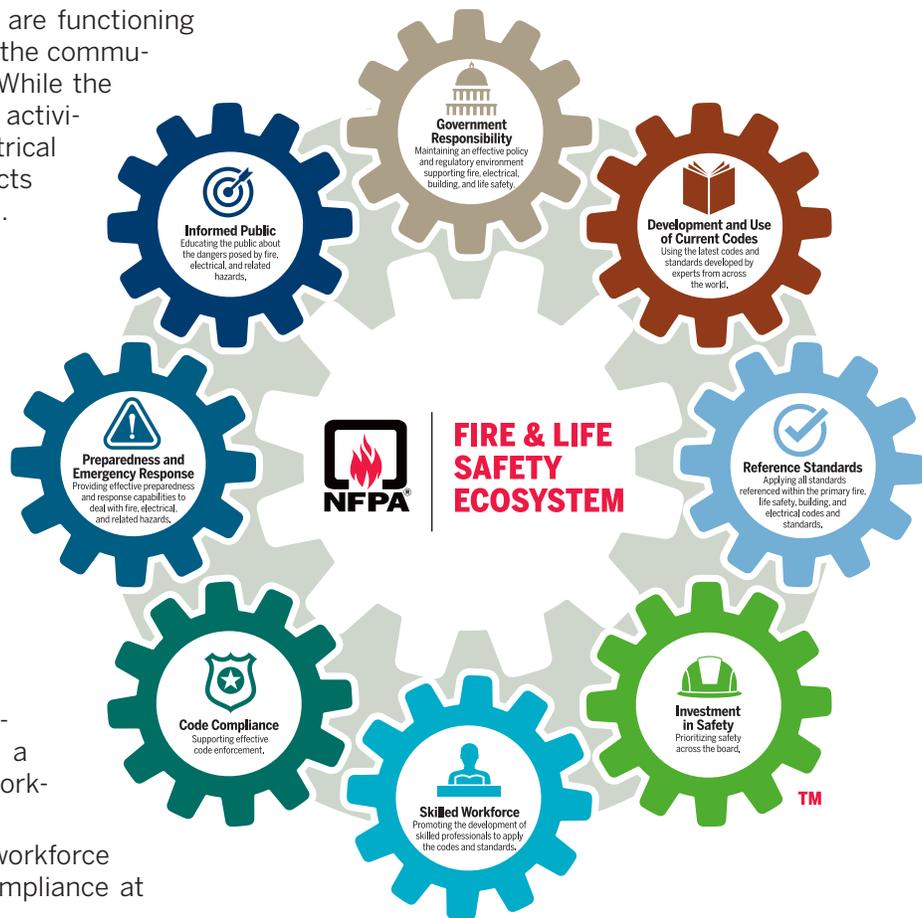
The leading information and knowledge resource
on fire, electrical and related hazards

This white paper contains some basic information about NFPA 70®, *National Electrical Code® (NEC®)*, and the *International Residential Code® (IRC®)*. It identifies some of the requirements in these documents as of the date of publication. This material is not the complete and official position of the NFPA on the referenced topics, which is represented solely by the NFPA documents in their entirety. For free access to the complete and most current version of these and all NFPA documents, please go to nfpa.org/standards. The NFPA makes no warranty or guaranty of the completeness of the information in this white paper. In using this information, you should rely on your independent judgment and, when appropriate, consult a competent professional and your local authority having jurisdiction.

NFPA FIRE AND LIFE SAFETY ECOSYSTEM

Inspection activities are an integral component of the NFPA Fire and Life Safety Ecosystem. When all of the cogs that comprise this system are functioning efficiently, the safety benefits to the community are derived to their fullest. While the most obvious cog for inspection activities is Code Compliance, the electrical inspector is impacted by or impacts other components of this system.

- Electrical inspection and inspectors that are supported by a responsible unit of government is where the process starts.
- Adoption and use of installation codes and standards and product certification standards developed in an open and fair process provides inspectors with the necessary tools to do their job.
- Investing in the necessary training and tools is a key component toward developing a skilled electrical inspection workforce.
- A skilled and knowledgeable workforce is paramount in achieving compliance at the time of installation.
- The electrical inspector can also be a valuable contributor in helping his or her community build more resilient electrical systems and be prepared for emergencies such as major power outages.
- Finally, electrical inspectors can be an important community resource to help the public understand that they have a role in the ecosystem, because once the installation is turned over to the property owner, it is most often the responsibility of the property owner to ensure that the property's electrical system remains compliant and safe.



The electrical inspection process can be tied to all the cogs in the ecosystem. When all of the parts are in place and functioning properly, the end result is a safe electrical system.

For more information on the NFPA Fire and Life Safety Ecosystem, visit [nfpa.org/ecosystem](https://www.nfpa.org/ecosystem).

NEW ELECTRICAL INSPECTORS MEMBER SECTION

Over the last few years AHJs have been clear in describing the unique challenges they face with code enforcement, namely conducting inspections, accurately and consistently applying code requirements, and educating their constituents. As part of our commitment in listening to our stakeholders, NFPA has added a new membership section exclusively for electrical inspectors.

Learn more and join today at: [nfpa.org/electricalinspectors](https://www.nfpa.org/electricalinspectors)

HOW TO USE THE RESIDENTIAL ELECTRICAL INSPECTION TASK LISTS

Using the collective expertise and experience of members of the NFPA Electrical Section and Electrical Inspection Section, the electrical inspection tasks included in this document were created for the purpose of helping those responsible for inspecting and approving electrical installations to do their job in an effective and efficient manner. How an individual organizes his or her inspection activities is entirely subjective, and these lists are not intended to prescribe a specific order in which the identified items are inspected.

The size of a project and the complexity of its installed systems is a major determinant in how much time the inspector can allocate to specific aspects of a project. Inspection tasks such as outlet spacing, outlet box fill, or verifying proper securing and supporting of wiring methods are present in virtually every project. As inspectors become more proficient in their inspection practices, such tasks become second nature and can generally be accomplished quite quickly based on simple visual observation — often without getting out the tape measure or dissecting a box to count conductors. A sampling here and there can provide the inspector with a pretty good feel as to whether the installer has performed his or her work in compliance with *NFPA 70®*, *National Electrical Code®* (*NEC®*). The time spent on each of the inspection tasks is important to managing the entire inspection process.

Although most of the tasks identified are common to the typical dwelling unit, there are some tasks associated with equipment types (e.g., electric vehicle supply equipment circuits) that may not be present in or at every dwelling, but are becoming more likely to be encountered in the dwelling unit electrical system.

Additionally, while these lists are comprehensive, it would be inaccurate to portray them as the only items an inspector could encounter in the course of performing residential inspections. We value any feedback from users of tasks that can be added to these lists to increase their value to the end user. Please visit community.nfpa.org/docs/DOC-3432.

DEFINED TERMS FROM THE NEC® APPLICABLE TO RESIDENTIAL ELECTRICAL INSTALLATIONS

The following terms are defined in Article 100 or in the definition section of an NEC article. These terms are used directly in one of the dwelling unit inspection tasks that follow or in an NEC requirement associated with

an inspection task. Familiarity with the definitions for these terms is essential to correctly applying the requirements of the NEC.

accessible (as applied to equipment)	bonding jumper (equipment)
accessible (as applied to wiring methods)	bonding jumper, main
accessible, readily	bonding jumper, supply-side
ampacity	branch circuit
appliance	branch circuit, appliance
approved	branch circuit, general purpose
arc-fault circuit interrupter	branch circuit, individual
attachment plug (plug cap)	branch circuit, multiwire
automatic	cabinet
bathroom	circuit breaker
bonded (bonding)	clothes closet
bonding conductor or jumper	concealed
	conductor
	bare
	covered
	insulated

conduit body	listed
connector, pressure (solderless)	live parts
continuous load	location, damp
cooking unit, counter-mounted	location, dry
copper-clad aluminum conductors	location, wet
cutout box	luminaire
dead front	multioutlet assembly
demand factor	neutral conductor
device	neutral point
disconnecting means	outlet
dwelling	overcurrent
dwelling unit	overload
one-family dwelling	panelboard
two-family dwelling	photovoltaic (PV) system
effective ground-fault current path	plenum
enclosed	power outlet
enclosure	premises wiring (system)
energized	qualified person
equipment	raceway
exposed (as applied to live parts)	rainproof
exposed (as applied to wiring methods)	rain tight
externally operable	receptacle
field evaluation body	receptacle outlet
field labeled	service
feeder	service cable
fitting	service conductors
ground	service conductors, overhead
grounded (grounding)	service conductors, underground
grounded, effectively	service drop
grounded conductor	service-entrance conductors, overhead system
grounding conductor, equipment (ECG)	service-entrance conductors, underground system
grounding electrode	service equipment
grounding electrode conductor	service lateral
ground-fault circuit-interrupter	service point
ground-fault current path	structure
guarded	switches
identified (as applied to equipment)	general-use switch
interrupting rating	general-use snap switch
intersystem bonding termination	isolating switch
isolated	motor-circuit switch
kitchen	ungrounded
labeled	utilization equipment
lighting outlet	voltage, nominal
lighting track (track lighting)	voltage to ground

watertight
 weatherproof
 ventilated
 voltage (of a circuit)

DEFINED TERMS FROM MODEL BUILDING CODES APPLICABLE TO

RESIDENTIAL ELECTRICAL INSTALLATIONS

The following terms are defined in the International Residential Code® (IRC®). The IRC requirements in which these terms are used could be applicable to the inspection of an overall electrical system or portion thereof. As a general rule, terms that are contained in both the NEC and IRC, but may be defined differently, are to be used in the context of the requirements of the code in which they are defined.

accessible

accessible, readily

accessory structure

air barrier

air-conditioning system

alteration

appliance

approved

approved agency

attic

attic, habitable

basement

basement wall

bathroom group

boiler

building

building, existing

building-integrated photovoltaic product

building line

building official

building thermal envelope

closet

conditioned air

conditioned area

conditioned floor area

conditioned space

construction documents

corrosion resistance

dwelling

dwelling unit

equipment

existing installations

fireblocking

fire separation distance

grade

guestroom

habitable space

heat pump

high-efficacy lamps

historic building

hydrogen-generating appliance

ignition source

jurisdiction

kitchen

label

labeled

listed

living space

lodging house

lot

lot line

manufactured home

manufacturer's designation	repair
manufacturer's installation instructions	room heater
mark	rough-in
mezzanine	shall
multiple station smoke alarm	single station smoke alarm
permit	sleeping unit
photovoltaic module	stair
photovoltaic panel	stairway
photovoltaic panel system	stairway, spiral
photovoltaic shingles	stationary fuel cell power plant
plenum	story
portable-fuel-cell appliance	
story above grade plane	
structure	
sunroom	
third-party certification agency	
third party certified	
third-party tested	
townhouse	
water heater	

INSPECTION TASKS FOR GENERAL REQUIREMENTS

These inspection tasks are derived primarily from Article 110 of the NEC® and address topics such as equipment, electrical and environmental ratings, work space, electrical connections, and field-applied labels and markings. Compliance with the NEC rules associated with these tasks can be verified at any stage of the inspection. Some tasks may be easier to inspect during plan review or rough wiring inspections, while others may not be complete until the final phase of the inspection process. For this reason, these general tasks are not included in the rough-wiring or final inspection task lists that appear in the pages that follow, but they may be part of those inspection processes.

- Determine if installation is covered within the scope of the NEC. **[90.2]**
- Verify that indoor-only and dry and damp location equipment is protected from exposure to the weather in instances where the building envelope is incomplete and does not protect equipment from exposure to the weather. **[110.11]**
- Verify equipment is installed in accordance with requirements associated with product certification (listing). **[110.3 (B)]**
- Determine if any portion of the installation or installed equipment necessitates *special permission* or *field evaluation*. **[90.4, 110.2]**
- Verify that overcurrent protective device interrupting ratings are not less than available fault current. **[110.9]**
- Verify that equipment short-circuit current ratings are not less than available fault current. **[110.10]**

- Verify that equipment environmental ratings are appropriate for the equipment location. **[110.11, 110.28]**
- Verify that equipment is secured to the mounting surface using appropriate mounting hardware. **[110.13(A), 300.11]**
- Verify that equipment has not been damaged to the point that safe operation is compromised, including damage caused by foreign substances such as paint or other coatings on internal parts of electrical equipment. **[110.12(B)]**
- Verify that unused openings in electrical equipment enclosures are properly closed or sealed. **[110.12(A)]**
- Verify that required work space and access is provided for electrical equipment. **[110.26]**
- Verify that required equipment space is provided above and below specific types of equipment, such as panelboards and switchboards. **[110.26(E)]**
- Verify that equipment location provides necessary space for required ventilation. **[110.13(B)]**
- Verify that illumination has been provided for indoor work spaces required for equipment such as service equipment, panelboards, and switchboards and that manual control of illumination is available. **[110.26(D)]**
- Verify that required work space is not compromised by storage. **[110.26(B)]**
- Verify coordination of conductor ampacity and insulation rating with terminal temperature ratings. **[110.14(C)]**
- Verify proper application of equipment termination and splicing devices. **[110.14(A) and (B)]**
- Verify that required field-applied warning labels have been provided. **[110.21(B)]**
- Verify that disconnecting means purpose and equipment served have been identified and that circuit directories for electrical distribution equipment such as panelboards and switchboards have been provided. **[110.22(A), 408.4(A)]**
- Verify identification of multiple power sources supplying panelboards and the type and location alternate source(s). **[408.4(B), 702.7(A)]**

INSPECTION TASKS FOR TEMPORARY SERVICES AND TEMPORARY WIRING

Most construction projects have some form of temporary electrical installation. In some cases, the project may involve a temporary electrical service that provides power to the site until the permanent service is installed and energized. Construction sites are often wet or damp and the use of portable (extension) cords is common. To protect workers against electrical hazards at the construction site, the use of ground-fault circuit interrupters as well as other protective techniques are required. Although temporary, the installation needs to be safe for as long as it will be in use. The following requirements are associated with temporary electrical installations and may amend or modify the general rules of the NEC®.

- Verify that the temporary service pole is securely set and correctly braced. **[110.13(A), 590.2(A)]**
- Verify proper installation of service equipment and conductors. **[Article 230 — Parts I through VIII, 590.4(A)]**
- Verify proper environmental ratings of electrical equipment. **[110.11, 120.28]**

- Verify proper bonding and grounding of temporary service. **[Article 250 — Parts I through V, 590.2(A)]**
- Verify all single-phase, 125-volt, 15-, 20- and 30-ampere receptacles are GFCI protected. **[590.6(A)(1)]**
- Verify that other voltage class temporary receptacles provide GFCI or SPGFCI protection or that assured equipment grounding conductor program is in effect. **[590.6(B)]**
- Verify weatherproof “in-use” covers are provided for 15- and 20-ampere, 125- and 250-volt receptacles. **[406.9(B)(1), 590.4(D)(2)]**
- Verify all temporary electrical equipment is properly secured and supported. **[110.13(A), 590.4(J)]**
- Verify that temporary wiring in or on a building or structure is removed upon completion of the construction project. **[590.3(D)]**

INSPECTION TASKS FOR DWELLING UNIT ROUGH WIRING INSTALLATION

Inspecting the electrical installation prior to the installation of wall and ceiling coverings provides the opportunity to identify potential problems that could manifest into safety hazards when the system is energized and in use. Ensuring wiring methods that will be concealed upon completion of the project are protected against damage through adherence to physical protection requirements can only be accomplished through a rough wiring inspection. Additionally, determining compliance with requirements on outlet and switch locations is much easier to perform during rough wiring, particularly if a correction is necessary. Typically the rough wiring inspection will involve more time than a final inspection because there is more of the electrical installation visible at that point in the construction project. The more complete a rough wiring inspection is will generally translate into less time that has to be spent during the final inspection.

The items included in this list are not arranged in a particular order other than to group items that relate to specific parts of the installation. The person performing the electrical inspection will develop his or her own approach to conducting the inspection, which may include allotting more time to certain items on the list. Given that there is a finite amount of time that can be spent on each inspection, the inspector must develop an approach that maximizes the time spent on each task, while also providing a level of inspection that yields a safe installation for the end user.

Wiring Methods and Equipment

- Verify proper environmental rating of wiring method installed in damp and wet locations. **[NEC 110.11 and the 110.10 and 110.12 sections for wiring method installed; IRC E3404.5, Table E3801.4]**
- Verify proper support, securement and protection of wiring method. **[NEC 300.4, 300.11(A), and the 300.30 section for installed wiring method; IRC E3904.3, Table E3802.1]**
- Verify proper support and mounting of boxes and other enclosures. **[NEC 110.13(A), 300.11(A), 314.23; IRC E3904.3, E3404.8, E3906.8]**
- Verify mounted position of box or enclosure in respect to anticipated wall or ceiling covering. **[NEC 314.20; IRC E3906.5]**
- Verify that boxes at luminaire, ceiling (paddle) fan, and other equipment locations have proper weight and equipment rating to support installed equipment. **[NEC 314.27(A) and (C), 422.18; IRC E3905.8, E4101.6]**
- Verify proper rating of boxes used at floor receptacle outlets. **[NEC 314.27(B); IRC E3905.7]**
- Verify proper environmental rating of boxes or enclosures installed in damp and wet locations. **[NEC 110.11, 312.2, 314.15; IRC E3905.11, E3907.2]**
- Verify wiring method is properly secured or attached to boxes or enclosures. **[NEC 312.5(C), 314.17(B) and (C); IRC E3905.3.2, E3907.8]**
- Verify conductor fill does not exceed box or enclosure capacity. **[NEC 314.16, 314.28(A); IRC E3905.12]**
- Verify box provides sufficient depth to accommodate equipment. **[NEC 314.24 (B); IRC E3905.4]**

- Verify that location of box will be accessible upon completion of construction. **[NEC 314.29; IRC E3905.10]**
- Verify that branch circuit equipment grounding conductors are connected to metal outlet boxes and that all equipment grounding conductors in a box are connected together. **[NEC 250.148; IRC E3908.13]**
- Verify proper use of conductors with white or gray insulation. **[NEC 200.7; IRC E3407.3 Exception]**
- Verify recessed luminaire housings are appropriate for the location in respect to thermal insulation and position in ceiling. **[NEC 110.3(B), 410.6, 410.116; IRC E3403.3, E4004.8, E4004.9]**
- Verify proper ratings or protection of boxes and cabinets installed in fire-rated assemblies. **[NEC 300.21; IRC E3402.2]**
- Verify proper rating of equipment installed in plenums and other spaces for environmental air. **[NEC 300.22; IRC E3904.7]**

Outlets and Branch Circuits

- Verify installation and spacing of all required outlets for wall and counter receptacles. **[NEC 210.52(A) through (C); IRC E3901.1 through E3901.4]**
- Verify installation of receptacle outlets in specific rooms and areas. **[NEC 210.52(D) through (I); IRC E3901.5 through E3901.12]**
- Verify installation of required lighting outlets. **[NEC 210.70(A)(1) through (A)(3); IRC E39003.1 through E3903.4]**
- Verify location of control for lighting outlet(s) serving interior stairways. **[NEC 210.70(A)(2)(3); IRC E3903.3]**
- Verify location of control for lighting outlet(s) serving storage and equipment spaces. **[NEC 210.70(A)(3); IRC E3903.4]**
- Verify installation of 20-ampere small appliance, laundry, bathroom, and garage receptacle branch circuits. **[NEC 210.11(C)(1) through (C)(4); IRC E3703.2 through E3703.5]**
- Verify that 120-volt, 20-ampere branch circuits installed to bathrooms, laundry areas, and garage supply only receptacle outlets in those areas unless otherwise permitted. **[NEC 210.11 (C)(2), (3), (4); IRC E3703.3 through E3703.5]**
- Verify that small-appliance branch circuits supply only the wall and counter receptacle outlets in the specified areas. **[NEC 210.52(B)(2); IRC E3702.2]**
- Verify that receptacle outlet for refrigerator is supplied from one of the small appliance branch circuits unless an individual branch circuit is installed for the purpose. **[NEC 210.52(B) Exception No. 2; IRC E3702.2, E3702.2 Exception]**
- Verify that outlets for appliances such as dishwashers, waste disposers, range hoods, and trash compactors are supplied by other than small appliance branch circuits. **[NEC 210.52(B), 422.16 (B)(4)(5); IRC E3702.2, E4101.3]**
- Verify receptacle outlet (if used) to supply dishwasher is located in space adjacent to space occupied by dishwasher. **[NEC 422.16(B)(2)(6); IRC E4101.3]**

- Verify that specific appliance circuits are properly rated. [**NEC 210.22, 210.23, 422.10; IRC E3702.3 through E3702.7**]
- Verify that heating and air-conditioning circuits are properly rated. [**NEC 424.3; IRC E3702.10 through E3702.12**]
- Verify that any outlets provided for electric vehicle supply equipment are supplied by individual branch circuits. [**NEC 625.40; IRC E3702.13**]

Feeders (if installed)

- Verify proper installation of wiring method. (See Wiring Methods and Equipment task list above.)
- Verify proper rating of feeder conductors. [**NEC215.2(A); E3704.1 through E3704.5, E3705.1 through E3705.5.2**]

REQUIREMENTS FROM INTERNATIONAL RESIDENTIAL CODE® (IRC®) THAT IMPACT ELECTRICAL INSTALLATIONS

The following requirements from the International Residential Code® (IRC®) are related to the NEC® requirement shown in parentheses, or they cover topics outside the scope of the NEC but may be included in another NFPA document. These requirements are identified to assist the person inspecting the electrical installation in applying the pertinent requirements from the applicable codes.

Special Requirements for Fire-Resistant Construction (tenant separation, lot line, garage walls) [NEC 300.21]

- IRC R302.4: dwelling unit rated penetrations
- IRC R302.5: garage opening or penetrations

Drilling/Notching Alterations to Structural Framing [NEC 300.4(A)]

- IRC R502.8: drilling, notching, cutting floor framing
- IRC R502.11.3: alteration to floor trusses
- IRC R602.6: drilling/notching studs
- IRC R802.7: cutting notching roof/ceiling
- IRC R802.10.4: alterations to roof trusses

Light and Ventilation

- IRC R303.3: bath exhaust fan (when required)
- IRC R303.7: interior stair illumination [**NEC 210.70(A)(2)**]

Smoke and Carbon Monoxide Alarms

- IRC R314: smoke alarm installation requirements [**NFPA 72, 29.5.1**]
- IRC R315: carbon monoxide alarms installation requirements [**NFPA 720 9.4.1**]

Flood Resistant Construction

- IRC R322.1.6: protection of mechanical, plumbing and electrical systems [**NEC 110.11**]

Solar and Energy Storage Systems

- IRC R324: solar energy systems (listing and structural loading requirements) [**NEC Article 690**]
- IRC R327: storage battery systems (listing and installation requirements) [**NEC Article 480 and 706**]

- IRC R907: roof mounted PV (Chapter 9, Roof Assemblies, reference to section 324 and NEC)
[NEC Article 690]

Energy Efficiency

- IRC N1102.4: air leakage (air barrier and insulation) for wiring methods, boxes and recessed lighting
- IRC N1102.4.5 (R402.4.5): recessed lighting **[NEC 410.116]**
- IRC N1104.1 (R404.1): high efficacy lamp requirement

Mechanical and Gas Piping

- IRC M1305.1.2.1: switch-controlled luminaire receptacle for mechanical **[NEC 210.70(A)(3)]**
- IRC G2411(310): gas pipe bonding (also addresses CSST separately) **[NEC 250.104(B), 110.3(B), and NFPA 54 7.12.1 and 7.12.2]**