

English

The importance of communication in electrical contracting

Subject Area: English

Grade Levels: 12

Date: 2013-08-05

Lesson Overview

Students will learn 1) the importance of written and oral communication in the building and construction industry and 2) the importance of attending to details and deadlines.

Students will work in teams/companies to bid on an electrical contract with a homebuilder in a competitive field in which time, relationships, and money are key constraints. Success requires clear communication with team members. Students will become familiar with technical vocabulary associated with the electrical industry to help establish a professional tone.

Materials Included in this Lesson

- Bid packet
 - Invitation to bid
 - floor plan
 - “take-off” sheet
 - packing slip/pricing sheet
- Reflection questions
- Project Rubric

Other Materials for this Lesson

- code packet
 - electrical code definitions
 - code for receptacle placement
- reading comprehension questions

Skills the Student will Learn

- Students will demonstrate written and oral communication skills and attention to detail.
- Students will write a combination of informational/explanatory/argument texts that include language and tone appropriate to a specific audience.
- Students will learn to read and interpret a CAD floor plan containing electrical components.
- Students will read and interpret technical documents containing national electrical codes and wiring illustrations.

Student Deliverables

- cover letter (x2)
- take off sheet / packing slip
- proposal draft
- proposal final draft
- PPT slides
- Reflection questions

Length of Lesson: 8 Days

Activity Day One

1. Introduce unit; review tone & cover letter basics; form teams/companies and review positions & responsibilities: 1. project manager 2. writer 3. editor 4. estimator. Group composes **cover letter** requesting opportunity to bid on project.

Activity Day Two

1. As students turn in cover letters, teacher reviews 2-3 samples on projector, walking class through each letter and discussing which company/team would receive invitations based on letter content.
2. Pass out invitations & student packets to each project manager, explaining to them alone the process & expectations. Teacher works directly only with project managers during the passing out/turning in of team products.
3. Project managers relay information to teams and the teams begin working.

Activity Day Three

1. Teams work on proposals and accompanying cover letter; teams complete activities associated with code packets.
2. Teams complete **take off sheet** & accompanying **packing slip/order form**, and **proposal outline**.

Activity Day Four

1. Teams complete written proposals, including graphics/charts; Project managers turn in completed proposals and new cover letters.

Activity Day Five

1. Teacher returns proposals to project managers, requesting changes/custom options.
2. Teams discuss and revise proposals to meet requested changes, reviewing appropriate electrical codes, etc.

Activity Day Six

1. Teams turn in **revised proposals**.

Activity Day Seven

1. Student teams give oral presentation of proposal, complete with **PPT slides**

Activity Day Eight

1. Teacher accepts/rejects proposals, explains process & emphasizes the importance of details
2. Debrief lesson and complete written reflection of activities
3. Project managers collect reflections and submit to teacher.

Enrichment Suggestions

For enrichment, students construct a floor plan of their own residence including the electrical components contained within it. Using a local or online home supply store, students can then estimate how much the cost/price of their residence comprises just the electrical components. For further enrichment, students can research to determine if their residence adheres completely to the electrical code.

Student Resources

NEC: <http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=70>

AutoCAD, student access: <http://students.autodesk.com/?nd=k12>

AutoCAD, product info: <http://www.autodesk.com/products/all-autocad>

Sacramento Area Electrical Apprenticeship: <http://www.340jatc.org/first.asp>

Common Core State Standards

CCSS for ELA:

W#1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence

W#2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content

W#4-7: Produce & revise writing that is organized, coherent, and appropriate to its audience; use technology to publish.

L#1,2,3,6: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking; apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style; Acquire and use accurately general academic and domain-specific words and phrases, sufficient for the college and career readiness level.

LS#4: Present information clearly and concisely, and logically so that listeners can follow, with tone and style appropriate to purpose

RI#4: Determine the meaning of words and phrases as they are used in a text, including technical meanings

RI#5a. Analyze the use of text features (e.g., graphics, headers, captions) in functional workplace documents

CTE Pathway Standards

D. Residential and Commercial Construction Pathway

- D3.0 Interpret and apply information from technical drawings, schedules, and specifications used in the construction trades.
 - D3.1 Identify the elements used in technical drawings, including types of lines, symbols, details, and views.
 - D3.4 Identify electrical symbols and other abbreviations used in construction drawings.
 - D3.7 Understand the sequencing and phases of residential and commercial construction projects.
- D5.0 Demonstrate foundation layout techniques according to construction drawings, specifications, and building codes.
 - D5.4 Develop a material take-off in accordance with construction drawings and specifications.
 - D5.5 Lay out location for reinforcements, expansion joints, openings, and embedded items based on construction drawings, specifications, and building codes.

2.0 Communications

- 2.1 Recognize the elements of communication using a sender–receiver model.
- 2.2 Identify barriers to accurate and appropriate communication.
- 2.3 Interpret verbal and nonverbal communications and respond appropriately.
- 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
- 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.
- 2.7 Use technical writing and communication skills to work effectively with diverse groups of people.

3.0 Career Planning and Management

- 3.3 Explore how information and communication technologies are used in career planning and decision making.
- 3.7 Recognize the importance of small business in the California and global economies.

4.0 Technology

- 4.1 Use electronic reference materials to gather information and produce products and services.
- 4.6 Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task.

5.0 Problem Solving and Critical Thinking

- 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
- 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
- 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
- 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
- 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
- 5.6 Know the available resources for identifying and resolving problems.

6.0 Health and Safety

- 6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
- 6.11 Comply with energy industry safety procedures and proper ways to perform work.

7.0 Responsibility and Flexibility

- 7.1 Recognize how financial management impacts the economy, workforce, and community.
- 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to changing and varied roles and responsibilities.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.

8.0 Ethics and Legal Responsibilities

- 8.1 Access, analyze, and implement quality assurance standards of practice.
 - 8.2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Energy, Environment, and Utilities industry sector.
 - 8.3 Demonstrate ethical and legal practices consistent with Energy, Environment, and Utilities sector workplace standards.
 - 8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.
 - 8.6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.
 - 8.7 Conform to rules and regulations regarding sharing of confidential information, as determined by Energy, Environment, and Utilities sector laws and practices.
- 9.0 Leadership and Teamwork
- 9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
 - 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
 - 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
 - 9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace.
 - 9.7 Participate in interactive teamwork to solve real Energy, Environment, and Utilities sector issues and problems.
- 10.0 Technical Knowledge and Skills
- 10.1 Interpret and explain terminology specific to the Energy, Environment, and Utilities sector.
 - 10.3 Construct projects and products specific to the Energy, Environment, and Utilities sector requirements and expectations.
- 11.0 Demonstration and Application
- 11.1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Energy, Environment, and Utilities sector program of study.

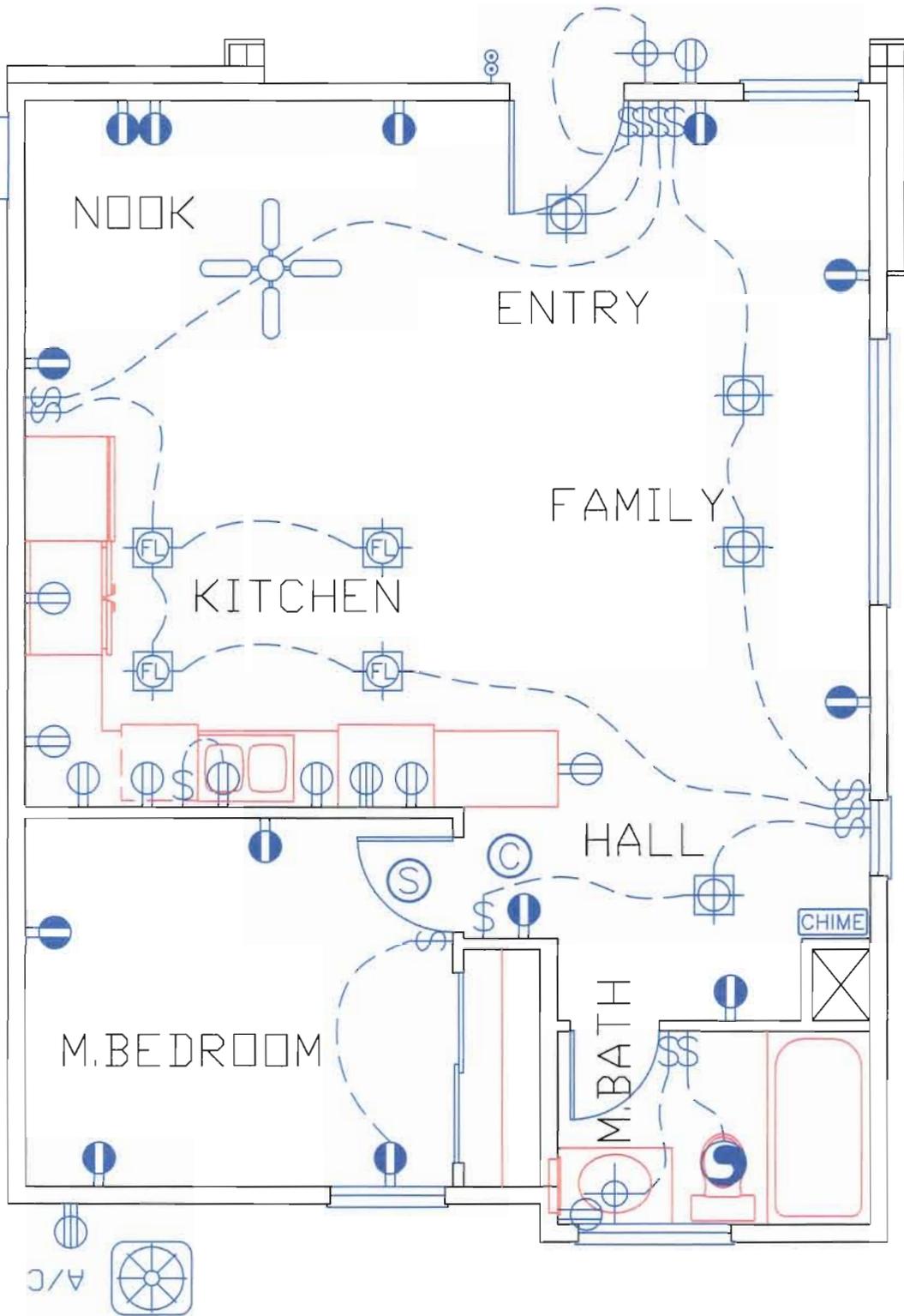
Lesson Plan Relevance To Externship

This lesson attempts to capture in miniature a sample workflow from a small business involved in the building industry. While serving as an extern with Rayco Electric in Rancho Cordova, I observed the importance of written and oral communication in making a small business successful. From entry-level workers in the warehouse to office managers and vice presidents upstairs, the key to maintaining a presence in the building industry is clear, effective communication.

200A PANEL

ADDRESS

EXTERIOR



1ST FLOOR PLAN

YOUR BUILDER

LOFTS

STUDIO

FPN: A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Therefore, the rules for overcurrent protection are specific for particular situations.

Overload. Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload.

Panelboard. A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

Plenum. A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

Power Outlet. An enclosed assembly that may include receptacles, circuit breakers, fuseholders, fused switches, buses, and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles, park trailers, or boats or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

Premises Wiring (System). Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point.

Such wiring does not include wiring internal to appliances, luminaires, motors, controllers, motor control centers, and similar equipment.

Qualified Person. One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

FPN: Refer to NFPA 70E[®]-2004, *Standard for Electrical Safety in the Workplace*, for electrical safety training requirements.

Raceway. An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this *Code*. Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular

concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.

Rainproof. Constructed, protected, or treated so as to prevent rain from interfering with the successful operation of the apparatus under specified test conditions.

Raintight. Constructed or protected so that exposure to a beating rain will not result in the entrance of water under specified test conditions.

Receptacle. A receptacle is a contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

Receptacle Outlet. An outlet where one or more receptacles are installed.

Remote-Control Circuit. Any electrical circuit that controls any other circuit through a relay or an equivalent device.

Sealable Equipment. Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure. The equipment may or may not be operable without opening the enclosure.

Separately Derived System. A premises wiring system whose power is derived from a source of electric energy or equipment other than a service. Such systems have no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system.

Service. The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

Service Cable. Service conductors made up in the form of a cable.

Service Conductors. The conductors from the service point to the service disconnecting means.

Service Drop. The overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service-entrance conductors at the building or other structure.

Service-Entrance Conductors, Overhead System. The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop.

Service-Entrance Conductors, Underground System. The service conductors between the terminals of the service equipment and the point of connection to the service lateral.

Table 210.24 Summary of Branch-Circuit Requirements

Circuit Rating	15 A	20 A	30 A	40 A	50 A
Conductors (min. size):					
Circuit wires ¹	14	12	10	8	6
Taps	14	14	14	12	12
Fixture wires and cords — see 240.5					
Overcurrent Protection	15 A	20 A	30 A	40 A	50 A
Outlet devices:					
Lampholders permitted	Any type	Any type	Heavy duty	Heavy duty	Heavy duty
Receptacle rating ²	15 max. A	15 or 20 A	30 A	40 or 50 A	50 A
Maximum Load	15 A	20 A	30 A	40 A	50 A
Permissible load	See 210.23(A)	See 210.23(A)	See 210.23(B)	See 210.23(C)	See 210.23(C)

¹These gauges are for copper conductors.

²For receptacle rating of cord-connected electric-discharge luminaires, see 410.62.

III. Required Outlets

210.50 General. Receptacle outlets shall be installed as specified in 210.52 through 210.63.

(A) Cord Pendants. A cord connector that is supplied by a permanently connected cord pendant shall be considered a receptacle outlet.

(B) Cord Connections. A receptacle outlet shall be installed wherever flexible cords with attachment plugs are used. Where flexible cords are permitted to be permanently connected, receptacles shall be permitted to be omitted for such cords.

(C) Appliance Receptacle Outlets. Appliance receptacle outlets installed in a dwelling unit for specific appliances, such as laundry equipment, shall be installed within 1.8 m (6 ft) of the intended location of the appliance.

210.52 Dwelling Unit Receptacle Outlets. This section provides requirements for 125-volt, 15- and 20-ampere receptacle outlets. The receptacles required by this section shall be in addition to any receptacle that is:

- (1) Part of a luminaire or appliance, or
- (2) Controlled by a wall switch in accordance with 210.70(A)(1), Exception No. 1, or
- (3) Located within cabinets or cupboards, or
- (4) Located more than 1.7 m (5½ ft) above the floor

Permanently installed electric baseboard heaters equipped with factory-installed receptacle outlets or outlets provided as a separate assembly by the manufacturer shall be permitted as the required outlet or outlets for the wall space utilized by

such permanently installed heaters. Such receptacle outlets shall not be connected to the heater circuits.

FPN: Listed baseboard heaters include instructions that may not permit their installation below receptacle outlets.

(A) General Provisions. In every kitchen, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar room or area of dwelling units, receptacle outlets shall be installed in accordance with the general provisions specified in 210.52(A)(1) through (A)(3).

(1) Spacing. Receptacles shall be installed such that no point measured horizontally along the floor line in any wall space is more than 1.8 m (6 ft) from a receptacle outlet.

(2) Wall Space. As used in this section, a wall space shall include the following:

- (1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways, fireplaces, and similar openings
- (2) The space occupied by fixed panels in exterior walls, excluding sliding panels
- (3) The space afforded by fixed room dividers such as free-standing bar-type counters or railings

(3) Floor Receptacles. Receptacle outlets in floors shall not be counted as part of the required number of receptacle outlets unless located within 450 mm (18 in.) of the wall.

(B) Small Appliances.

(1) Receptacle Outlets Served. In the kitchen, pantry, breakfast room, dining room, or similar area of a dwelling

unit, the two or more 20-ampere small-appliance branch circuits required by 210.11(C)(1) shall serve all wall and floor receptacle outlets covered by 210.52(A), all countertop outlets covered by 210.52(C), and receptacle outlets for refrigeration equipment.

Exception No. 1: In addition to the required receptacles specified by 210.52, switched receptacles supplied from a general-purpose branch circuit as defined in 210.70(A)(1), Exception No. 1, shall be permitted.

Exception No. 2: The receptacle outlet for refrigeration equipment shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.

(2) No Other Outlets. The two or more small-appliance branch circuits specified in 210.52(B)(1) shall have no other outlets.

Exception No. 1: A receptacle installed solely for the electrical supply to and support of an electric clock in any of the rooms specified in 210.52(B)(1).

Exception No. 2: Receptacles installed to provide power for supplemental equipment and lighting on gas-fired ranges, ovens, or counter-mounted cooking units.

(3) Kitchen Receptacle Requirements. Receptacles installed in a kitchen to serve countertop surfaces shall be supplied by not fewer than two small-appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the same kitchen and in other rooms specified in 210.52(B)(1). Additional small-appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in 210.52(B)(1). No small-appliance branch circuit shall serve more than one kitchen.

(C) Countertops. In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop spaces shall be installed in accordance with 210.52(C)(1) through (C)(5).

Where a range, counter-mounted cooking unit, or sink is installed in an island or peninsular countertop and the width of the countertop behind the range, counter-mounted cooking unit, or sink is less than 300 mm (12 in.), the range, counter-mounted cooking unit, or sink is considered to divide the countertop space into two separate countertop spaces as defined in 210.52(C)(4). Each separate countertop space shall comply with the applicable requirements in 210.52(C).

(1) Wall Countertop Spaces. A receptacle outlet shall be installed at each wall countertop space that is 300 mm (12 in.) or wider. Receptacle outlets shall be installed so that no point along the wall line is more than 600 mm (24 in.) measured horizontally from a receptacle outlet in that space.

Exception: Receptacle outlets shall not be required on a wall directly behind a range, counter-mounted cooking unit, or sink in the installation described in Figure 210.52(C)(1).

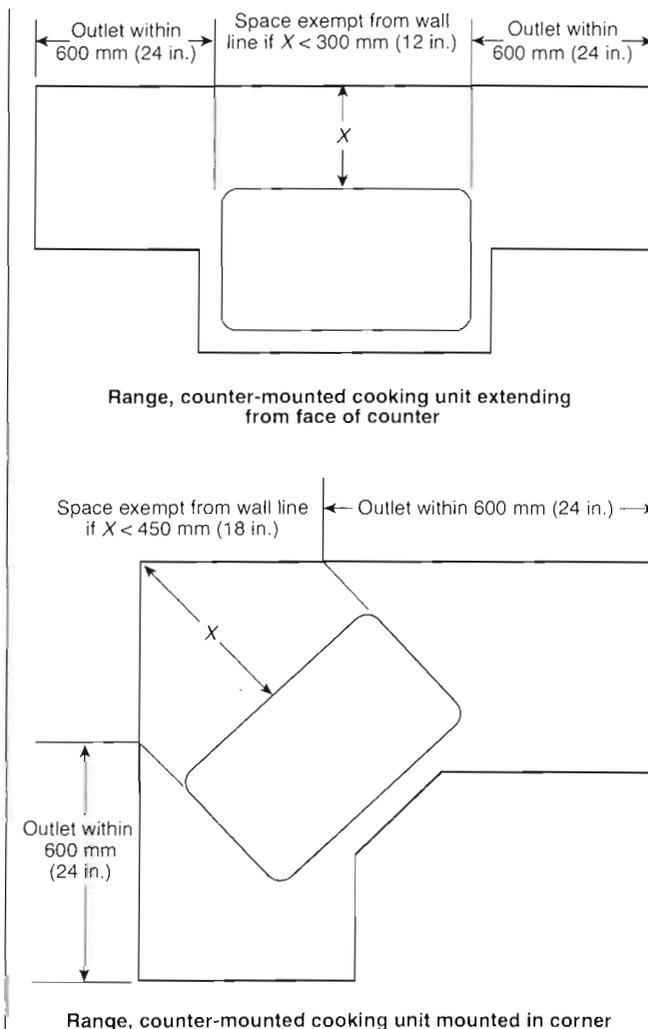


Figure 210.52(C)(1) Determination of Area Behind a Range, or Counter-Mounted Cooking Unit or Sink.

(2) Island Countertop Spaces. At least one receptacle shall be installed at each island countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater.

(3) Peninsular Countertop Spaces. At least one receptacle outlet shall be installed at each peninsular countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop is measured from the connecting edge.

(4) Separate Spaces. Countertop spaces separated by rangetops, refrigerators, or sinks shall be considered as

separate countertop spaces in applying the requirements of 210.52(C)(1), (C)(2), and (C)(3).

(5) Receptacle Outlet Location. Receptacle outlets shall be located above, but not more than 500 mm (20 in.) above, the countertop. Receptacle outlets rendered not readily accessible by appliances fastened in place, appliance garages, sinks, or rangetops as covered in 210.52(C)(1), Exception, or appliances occupying dedicated space shall not be considered as these required outlets.

Exception to (5): To comply with the conditions specified in (1) or (2), receptacle outlets shall be permitted to be mounted not more than 300 mm (12 in.) below the countertop. Receptacles mounted below a countertop in accordance with this exception shall not be located where the countertop extends more than 150 mm (6 in.) beyond its support base.

- (1) Construction for the physically impaired
- (2) On island and peninsular countertops where the countertop is flat across its entire surface (no backsplashes, dividers, etc.) and there are no means to mount a receptacle within 500 mm (20 in.) above the countertop, such as an overhead cabinet

(D) Bathrooms. In dwelling units, at least one receptacle outlet shall be installed in bathrooms within 900 mm (3 ft) of the outside edge of each basin. The receptacle outlet shall be located on a wall or partition that is adjacent to the basin or basin countertop, or installed on the side or face of the basin cabinet not more than 300 mm (12 in.) below the countertop.

(E) Outdoor Outlets. Outdoor receptacle outlets shall be installed in accordance with (E)(1) through (E)(3). [See 210.8(A)(3).]

(1) One-Family and Two-Family Dwellings. For a one-family dwelling and each unit of a two-family dwelling that is at grade level, at least one receptacle outlet accessible while standing at grade level and located not more than 2.0 m (6½ ft) above grade shall be installed at the front and back of the dwelling.

(2) Multifamily Dwellings. For each dwelling unit of a multifamily dwelling where the dwelling unit is located at grade level and provided with individual exterior entrance/egress, at least one receptacle outlet accessible from grade level and not more than 2.0 m (6½ ft) above grade shall be installed.

(3) Balconies, Decks, and Porches. Balconies, decks, and porches that are accessible from inside the dwelling unit shall have at least one receptacle outlet installed within the perimeter of the balcony, deck, or porch. The receptacle

shall not be located more than 2.0 m (6½ ft) above the balcony, deck, or porch surface.

Exception to (3): Balconies, decks, or porches with a usable area of less than 1.86 m² (20 ft²) are not required to have a receptacle installed.

(F) Laundry Areas. In dwelling units, at least one receptacle outlet shall be installed for the laundry.

Exception No. 1: In a dwelling unit that is an apartment or living area in a multifamily building where laundry facilities are provided on the premises and are available to all building occupants, a laundry receptacle shall not be required.

Exception No. 2: In other than one-family dwellings where laundry facilities are not to be installed or permitted, a laundry receptacle shall not be required.

(G) Basements and Garages. For a one-family dwelling, the following provisions shall apply:

- (1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage with electric power.
- (2) Where a portion of the basement is finished into one or more habitable rooms, each separate unfinished portion shall have a receptacle outlet installed in accordance with this section.

(H) Hallways. In dwelling units, hallways of 3.0 m (10 ft) or more in length shall have at least one receptacle outlet.

As used in this subsection, the hall length shall be considered the length along the centerline of the hall without passing through a doorway.

210.60 Guest Rooms, Guest Suites, Dormitories, and Similar Occupancies.

(A) General. Guest rooms or guest suites in hotels, motels, sleeping rooms in dormitories, and similar occupancies shall have receptacle outlets installed in accordance with 210.52(A) and 210.52(D). Guest rooms or guest suites provided with permanent provisions for cooking shall have receptacle outlets installed in accordance with all of the applicable rules in 210.52.

(B) Receptacle Placement. In applying the provisions of 210.52(A), the total number of receptacle outlets shall not be less than the minimum number that would comply with the provisions of that section. These receptacle outlets shall be permitted to be located conveniently for permanent furniture layout. At least two receptacle outlets shall be readily accessible. Where receptacles are installed behind the bed, the receptacle shall be located to prevent the bed from

Code Check Electrical

BY REDWOOD KARDON

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Key

Code information is followed by a bracketed number or word [230-24b, utility]

The number refers to the code number in the 1999 National Electric Code, abbreviated as "NEC." The NEC is a registered trademark of the National Fire Protection Association.

ET-3 = Code Check table

Fig. 3 = Illustration 3

Ex- = Exception to preceding citations

[local] = Code interpretation varies widely. Check with your local municipality for specific codes in your area.

[energy] = Energy conservation measures modeled on California Title 24 or the Model Energy Code.

[manu.] = Follow manufacturer's installation instructions

[n/a] = Not addressed

[t 310.5] = Table in NEC

[trade] = Unwritten trade practice. "The way it has always been done."

Organizations

AGA = American Gas Association; www.aga.com

ANSI = American National Standards Institute; www.ansi.org

ASHRAE = American Society of Heating, Refrigerating and Air Conditioning Engineers; www.ashrae.org

CSA = Canadian Standards Association; www.cssinfo.com/info/csa.html

ETL = ETL Testing Laboratories; www.etl.com

FM = Factory Mutual Testing Services; www.factorymutual.com

ICBO = International Conference of Building Officials; www.icbo.org

ICC = International Code Council; www.intlcode.org

NEC = National Electric Code, published by the NFPA

NEMA = National Electrical Manufacturers Association; www.nema.org

NFPA = National Fire Protection Association; www.nfpa.org

Romex = a trademark registered to the General Cable Corporation.

UL = Underwriters Laboratory; www.ul.com

UPC = Uniform Plumbing Code, International Association of Plumbing and Mechanical Officials; www.iapmo.org

Wiremold = Wiremold Company; www.wiremold.com

Abbreviations

AC = Alternating Current or Air Conditioning

AC = Armor Clad cable; Fig. 101

AHJ = Authority Having Jurisdiction is the building inspection department, which could be local, state, or federal. They have the final word on what is "to code."

AL = Aluminum

AWG = American Wire Gauge

BX = trade name for AC cable

CU = Copper

DB = Direct Burial is a designation from UL for clamps that may be buried.

DC = Direct Current

EGC = Equipment Grounding Conductor

FLA = Full Load Amps. A motor's nameplate current rating.

FMC = Flexible Metal Conduit

Branch Circuit, Multiwire (residential) = A branch circuit consisting of two hot conductors having a 240volt potential between them, and a grounded conductor having 120volt difference between it and each hot conductor. Fig. 48.

Branch Circuit, Small Appliance = A branch circuit supplying portable (can be unplugged and moved without tools) household kitchen appliances.

Contactors = A device used to switch large electric currents, usually operated by an electro-mechanical relay (similar in action to the solenoid in a car).

Controller = A device to govern the flow of electrical loads typically associated with motors.

Feeder = Conductors supplying panelboards other than service panels.

Grounded Conductor = A current-carrying conductor that is connected to earth and that may be a neutral. Fig. 10.

Grounding Conductor = A non-current carrying conductor that provides an alternative path for equipment faults. Fig. 12b.

Hertz = A measure of the frequency of alternating current. In North America the standard is 60 Hertz.

Heater = A thermally reactive device used to protect motor circuits from overload.

Load = The electrical demand in watts or horsepower of a piece of electrical equipment.

Open Conductors = When applied to overhead conductors this would apply to cable groupings that do not have an overall covering (sheathing). SE cable (Fig. 100) are not considered open conductors.

Panelboards = Commonly referred to as the "guts" of an electrical panel. The NEC refers to a panelboard as an assembly (busbars, circuit breakers, etc.) designed to be placed in a "cabinet." What is commonly called an electrical panel is, by NEC standards, made up of a panelboard inside a cabinet.

Power = Power is a product of volts and amps and can be expressed as either watts (true power) or VA (apparent power).

RE = Renewable Energy.

Service = The conductors and equipment providing a connection to the utility power source.

Service Equipment = The equipment where the power conductors entering the building can be switched off to disconnect the premises' wiring from the power source.

SFD = Single-Family Dwelling.

Starter = A motor controller made up of a contactor and heaters.

Sub-Feeder = See Feeder.

True Power = Power consumed, used, or dissipated; measured in watts.

Thomas Alva Edison, the Wizard of Menlo Park (New Jersey), knew a good idea when he saw one. Fig. 1. The lightbulb was invented in Europe while he was still a boy. These early versions were expensive and lasted only for short periods. Edison became obsessed with producing an affordable, long-lasting lightbulb. Along with his dedicated staff, he tested thousands of materials and methods, day and night. Finally, in 1879, the combination of science, industrial design, and very talented people paid off with a patent for the modern lightbulb.

By the spring of 1880, Edison was selling lots of lightbulbs. Electric power stations sprung up everywhere to meet the ravenous appetite for electricity. To this day, the lightbulb is the symbol for a good idea.

Electrical power proved to have unexpected consequences on society. During the 1890s it became obvious that there was a direct relationship between the widening distribution of electricity and an epidemic of residential fires. Insurance claims skyrocketed. By 1897, the need for action became overwhelming. From across the country insurance companies assembled fire marshals, engineers, electricians, and other interested parties to develop wiring guidelines to control their losses. The resulting standards, which have evolved into the National Electric Code, were the first building codes in the United States.

At their source, most building codes make sense. They are born of grisly mistakes and costly disasters. For insurance companies it's not personal but about



Fig. 1 Thomas Alva Edison

GEC = Grounding Electrode Conductor
 GES = Grounding Electrode System
 GFCI = Ground Fault Circuit Interrupter
 Hz = Hertz
 IMC = Intermediate Metal Conduit
 kcmil = 1000 circular mill units used for large conductors.
 KVA = KiloVolt Amperes = 1000 Volts x Amps. KVA is a measure of the available power (apparent power) output of a transformer.
 LFMC = Liquidtight Flexible Metal Conduit
 MC = Metal Clad cable similar to BX
 NM = Non-Metallic sheathed cable; the NEC name for Romex
 OCPD = Overcurrent Protective Device. Usually a breaker in residential wiring.
 RNMC = Rigid Nonmetallic Conduit = PVC
 RMC = Rigid Metal Conduit
 SE = Service Entrance cable
 UF = Underground Feeder cable. UF cable is essentially fortified NM cable.
 USE = Underground Service Entrance cable
 VA = Volts x Amps
 VAC = Volts Alternating Current
 VDC = Volts Direct Current

Glossary

Alternating Current = The most common form of electrical energy distribution where the current flows in one direction and then in the other in regular cycles.

Apparent Power = Available power from a transformer measured in VA.

Branch Circuit = The circuit conductors between the final OCPD (breaker or fuse) and the outlet or outlets it supplies.

Branch Circuit, General Purpose = A branch circuit that supplies a number of outlets for lighting and appliances.

Branch Circuit, Individual = A branch circuit that supplies only one piece of equipment.

the bottom line. For me and you it's about the lives of our clients and the people we love. Call me a "wire cop"—it won't deter me. Experience has shown me that uniform construction practices and building codes are good things.

The registration marks listed below represent the more widely known testing laboratories that maintain standards of safety and uniformity.

Fig. 2 Testing laboratory seals must be prominently displayed on electrical equipment

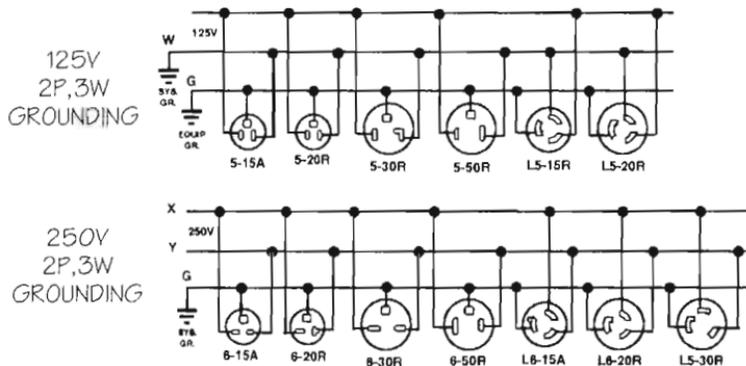


Please note this book has not been tested or approved by any electrical testing agency. The author and publisher assume no liability if this book is plugged in.

Fig. 3 NEMA plug and receptacle configurations

Standards established by the National Electrical Manufacturers Association are the reason you can plug your refrigerator into any "standard" 3-hole 120volt outlet.

NEMA



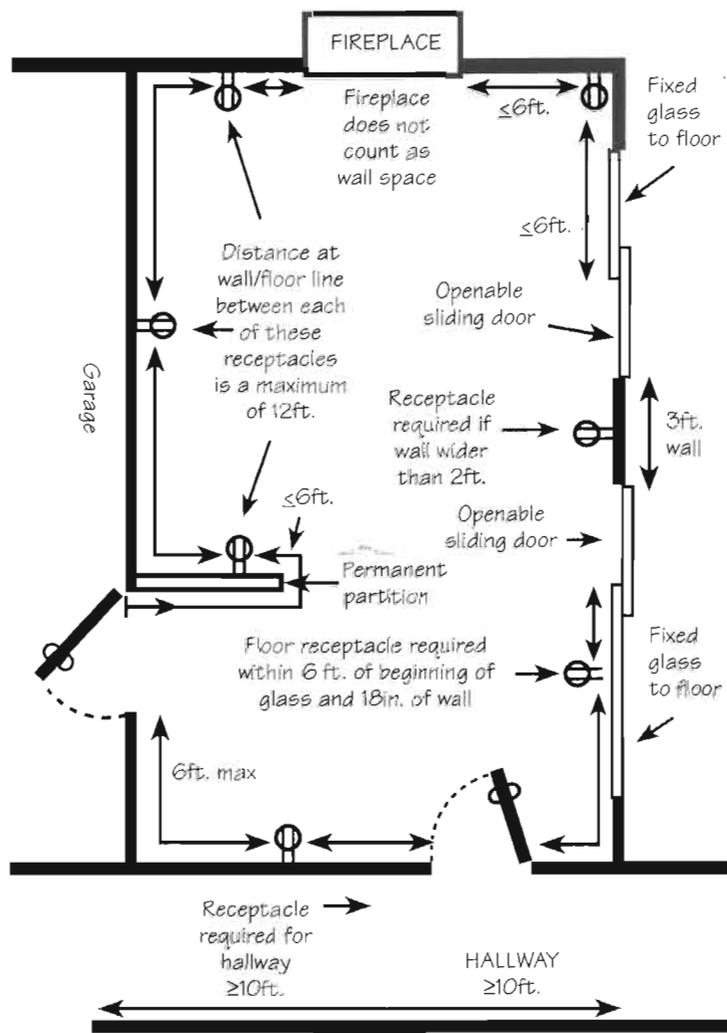
Rough and Final Inspections

General Purpose Circuits

Receptacles

- 6ft. cord can be plugged in anywhere along wall . . . Fig. 67, 68 [210-52a] [4401.2]
- Any wall ≥ 2 ft. wide req's. receptacle Fig. 67 [210-52a] [4401.2]
- Hallway ≥ 10 ft. req's. receptacle Fig. 67 [210-52h] [4401.11]
- All splicing must be done with approved connectors Fig. 69 [110-14]
- Flexible cords and cables not to be used in lieu of permanent wiring methods [400-7]

Fig. 67 6ft. & 12ft. Rule



ET-9 Example of Box Fill Calculation

Wires that do not leave box don't count

3- Black 12AWG x 2.25 cu.in.	6.75cu.in.
3- White 12AWG x 2.25 cu.in.	6.75cu.in.
3- Grounding wires (counts as 1)	2.25cu.in.
3- Internal cable clamps (counts as 1)	2.25cu.in.
1- Receptacle	4.5cu.in.
Total fill	22.5cu.in.

22.5cu.in. would exceed the maximum fill allowed for a 18cu.in. box.

Fig. 71
Overfilled
18cu.in.
Box

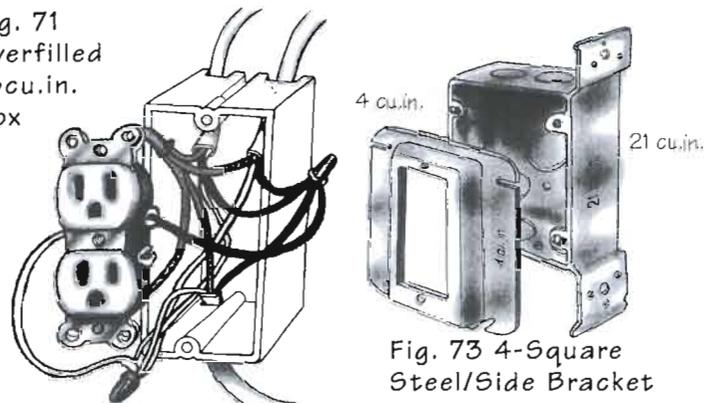


Fig. 73 4-Square
Steel/Side Bracket

Fig. 72
Pancake
Boxes



Water Heater

- In-sight disconnect or lockable out-of-sight switch . . . see Fig. 90 [422-31b]
 - Bond hot, cold and gas pipes [250-104a,b]
- Very important to do this in older systems that don't have equipment grounds.

Electric Furnace

- Branch circuit—125% of (heat watts + motor FLC) [424-3b]
- Motor $> \frac{1}{8}$ hp: In-sight (50ft. rule) or lockable out-of-sight switch Fig. 90 [424-19a2]

Disconnect Means

No motor $> \frac{1}{8}$ hp:

- In-sight circuit breaker, switch OR unit switch that opens all ungrounded conductors Fig. 90, 91 [424-19a1] [t 4601.7]

Motor $> \frac{1}{8}$ hp.:

- In-sight (50ft. rule) or lockable out-of-sight switch Fig. 90, 91 [424-19a2] [t 4601.7]

Gas Furnace

- Fused (125%) disconnect (SSU switch) (unless motor thermally protected) Fig. 74, 90, 91 [430-32c1, local]
- Separate circuit [422-12]
- Lighting outlet switched at entry required. [210-70c]
- 120volt receptacle on the same level and within 25ft. [210-63]

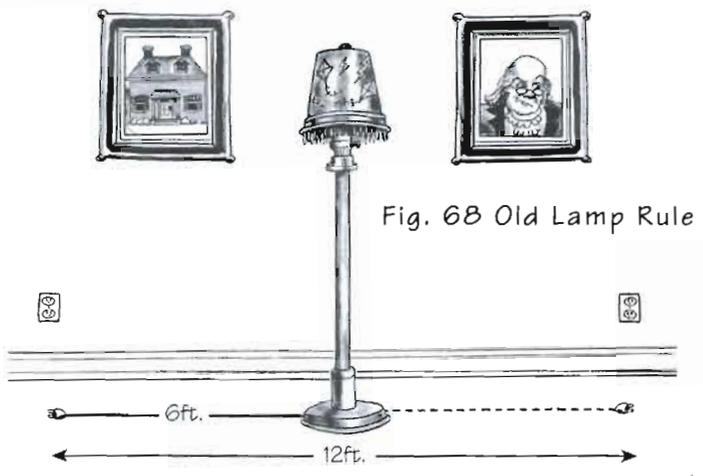


Fig. 68 Old Lamp Rule

Fig. 69 Splicing Devices



Fig. 70 Don't Crush, Crimp



Boxes

- Metal boxes grounded with approved method Fig. 76, 77 [250-148a]
- Wallboard repaired-no side gaps >1/4in. to outlet box [370-21]
- Boxes and conduit fittings must remain accessible [370-29]
- Outlet boxes shall be flush with combustible surfaces [370-20]
- Min. 6in. of "free conductor" in box and 3in. past face of box [300-14]
- All splicing must be done in electrical boxes except [300-15a] underground listed fittings and Knob & Tube repair Fig. 54 [300-5e,300-15b-h]

Box Fill

- 3in. (4cu.in.) pancake box too small for 14/2 Romex Fig. 72 [370-16b]
- 4in. (6cu.in.) pancake box end of 14/2 run only Fig. 72 [370-16b]
- 18cu.in. box w/device too small for 3 x 12/2 Romex Fig. 71 [370-16b]

Elements that must be factored in to box fill calculations are: [370-16]

- Conductor volume see ET-8
- Internal clamps-add the value of one conductor (largest conductor in box)
- Devices like switches and receptacles-count as two wires
- Equipment grounds-all grounds count as one wire

ET-8 Volume Per Wire (T370-16b)	# of conductors	extensions
14AWG	2.00cu.in.	
12AWG	2.25cu.in.	
10AWG	2.5cu.in.	
8AWG	3cu.in.	
6AWG	5cu.in.	
	Total	

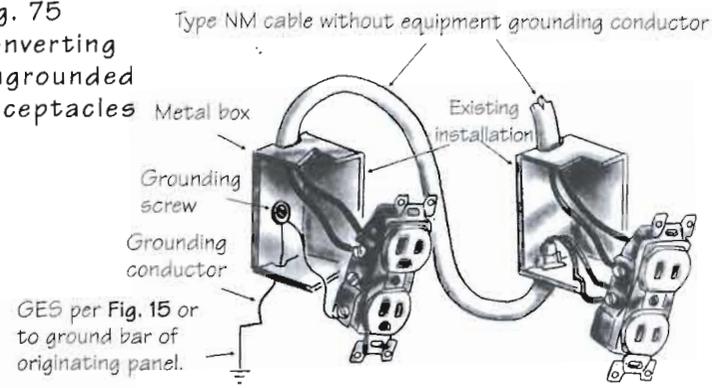


Fig. 74 SSU-Fused Disconnect

Air Conditioning (window units)

- Disconnect may be cord and plug if unit controls <6ft. of the floor OR [440-63]
- Disconnect may be cord and plug if there is in-sight disconnect . . . [440-63]
- 120-volts window-unit cord max. 10ft. [440-64]
- 200+-volt window unit cord max. 6ft. [440-64]

Fig. 75 Converting Ungrounded Receptacles



- Ungrounded GFCI-protected receptacles are required to be marked "No Equipment Ground." [210-7d]

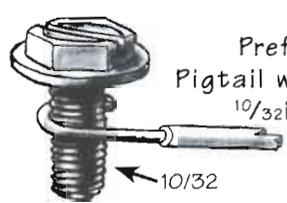


Fig. 76 Prefabricated Pigtail with Green 10/32in. Screws



Fig. 77 Ground Clip

Lights

- Recessed light (non-IC) 3in. from insulation [410-66b]
- Recessed light (non-IC) 1/2in. from combustibles [410-66a]
- Wall switched lighting outlets req'd. in all habitable rooms, baths, halls, stairs (3 way/>6 steps), garages, outdoor entrances, storage or utility areas, attics, and basements with equipment [210-70a]
- Address number must be illuminated [local]

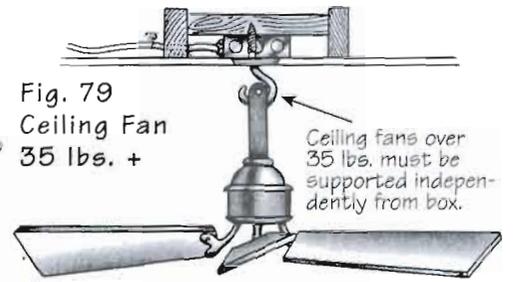
Paddle Fans

- Not to be supported by standard electrical boxes [370-27c, 422-18]

Fig. 78 Paddle Fan Support Bracket



Fig. 79 Ceiling Fan 35 lbs. +



Bathroom

- Receptacle required within 3ft. of basin[210-52d]
- Outlets must not be installed face up on horizontal surface[210-52c5]
- Separate 20amp circuit required for bathrooms (no lights)[210-11c3]
- Primary light energy-efficient (not incandescent)[energy]
- Space heater-max. watts on a general-purpose ckt.:15amp circuit-900watt; 20amp circuit-1,200watt[210-23a]

Hydromassage Bathtub Circuit

- Must be GFCI-protected[680-70]
- Motor must be accessible for servicing[110-3b, 430-14]
- Disconnect within sight of motorFig. 90, 91 [422-31b]
- Disconnect may be cord and plug[422-32a]

Utility

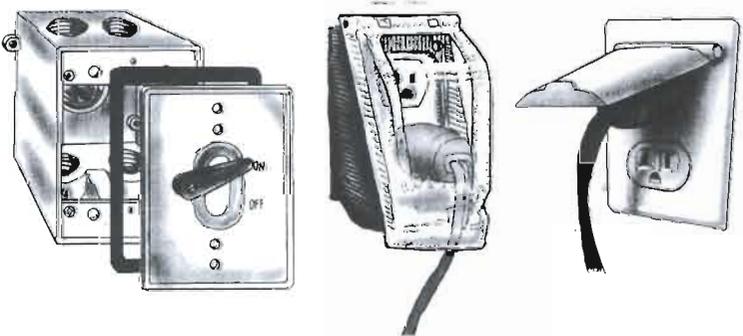
Laundry

- Separate 20amp circuit required for laundry (no lights)[210-11c2]
- Outlets must be within 6ft. of equipment[210-50c]
- Electric dryer min. feed 30amp (10AWG wire)[220-18]

Outdoors

- Receptacles at grade front & rear GFCI-protected (at grade = within 6ft. 6in. of ground)Fig. 81 [210-52e]
- Doors to outside req. lighting outlet[210-70a]
- Rain-tight cover for unattended cordsFig. 81 [410-57b]
- All equipment exposed to weather must be suitable for wet locationFig. 80 [110-3a1]
- Boathouse receptacles must be GFCI-protectedFig. 81 [555-3]

Fig. 80 Weatherproof Boxes Are Threaded, Switch Covers Raintight
 Fig. 81 Special Listed Outdoor Cover
 Fig. 82 Standard Outdoor Cover



Garage

- Min. 1 lighting outlet & 1 GFCI receptacle required. . . .Fig. 31 [210-52g, 70a]
- All receptacles GFCI-protected except single receptacle, inaccessible behind a fixed appliance, e.g. freezerFig. 31 [210-8a2ex.2]
- Subpanels shall not penetrate modified 1hr. wall[IRC321.3.2]
- Sep. structure req's GES if > 1 branch cir.Fig. 49 [250-32a]
- Automatic opener must have edge sensor[110-3b]

Closet

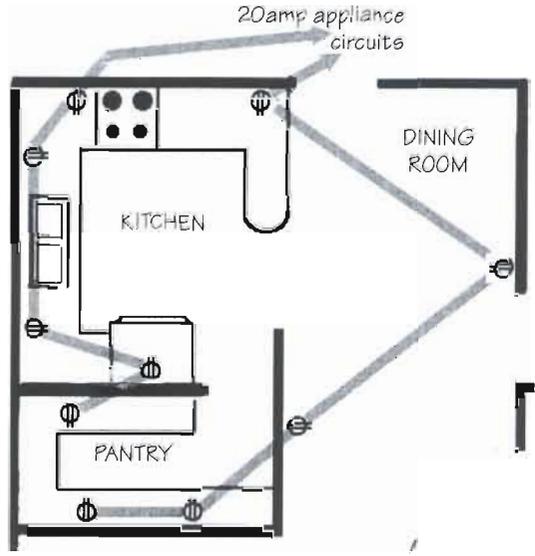
- Enclosed incandescent-12in. of clearanceFig. 83 [410-8d1]
- Surface fluorescent or recessed incandescent-6in. clearance[410-8d2, 3]
- No open incandescent bulb-type fixtures[410-8c]

The Kitchen

Kitchen Circuits

- Two 20amp small-appliance circuits required ✓Fig. 85 [210-11c1]
- Countertop-min. 2 small-appliance circuitsFig. 85 [210-52b3]
- All general-purpose receptacles in kitchen, dining room, etc., must be on small-appliance ckt.Fig. 85 [210-52b1]
- No lighting permitted on these circuits[210-52b2]
- No point along counter >24in. from small-appliance receptaclesFig. 86 [210-52c1]
- Counters ≥12in. wide require receptacles[210-52c1]
- GFCI-protect any countertop receptacle seeFig. 85 [210-8a6]
- Island & peninsulas >12in. x 24in. req. min. 1 outlet ...Fig. 87 [210-52c.2,3]
- Island & peninsula receptacles may be mounted ≤12in. below countertopFig. 87 [210-52c.5ex]
- Multiwire (3-wire 240volt circuit) to a duplex receptacle requires a tie-bar breakerFig. 89 [210-4b]
- Primary light energy efficient (not incandescent)[energy]

Fig. 85 Kitchen Countertop Layout



Countertop may be shared with dining room & pantry.

All countertop receptacles must be GFCI protected.

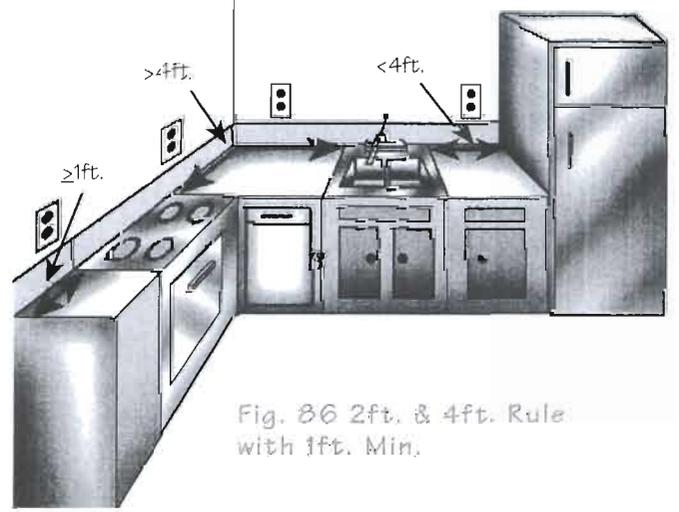


Fig. 86 2ft. & 4ft. Rule with 1ft. Min.

Rubric for the Electrical Contract bid Project

Student Deliverables	1 Exceeds Expectations	2 Meets Expectations	3 Approaches Expectations	4 Fails to meet Expectations
cover letter	Uses correct business letter format. Clear, concise, and free from grammar and spelling errors. Content convinces homebuilder to call.	Uses correct business letter format. Free from grammar and spelling errors. The content adequately convinces a homebuilder to call.	Uses correct business letter format. Letter contains some grammar and spelling errors. The content of this letter does not make sense to the reader.	Business formatting is not used in this letter. There are multiple grammar and spelling errors that interfere with a reader's understanding of the letter.
take off sheet & Materials order form	Sheet is accurate and legible.	Sheet is legible, but may contain 1-2 errors or omissions.	Sheet is legible but contains more than 2 errors or omissions.	Sheet is illegible and/or contains several errors or omissions.
proposal draft / outline	N/A	Writing may contain some grammar and spelling errors. Layout and content is accurate and supports reader understanding and makes homebuilder consider bid.	Writing may contain some grammar and spelling errors. Layout may be distracting and/or content may be inaccurate. Homebuilder will likely not accept bid.	Draft and/or outline not submitted
proposal final draft	Clear, concise and free from grammar and spelling errors. Layout is aesthetically pleasing and content is accurate, both enhancing reader understanding. Persuades homebuilder to accept bid.	Writing is free from grammar and spelling errors. Layout and content is accurate and supports reader understanding and makes homebuilder consider bid.	Writing may contain some grammar and spelling errors. Layout may be distracting and/or content may be inaccurate. Homebuilder will likely not accept bid.	Writing contains multiple grammar and spelling errors. Layout interferes with understanding and/or content is inaccurate. Homebuilder will refuse to conduct further business with your company.
PPT slides	Clear, legible text and appropriate visuals enhance presentation	Clear, legible text and appropriate visuals support presentation	Text and visuals relate to presentation, but design may be distracting or interfere with readability.	Text and/or visuals do not relate to presentation. Design is distracting and hinders audience understanding.
Reflection	Clear, concise and free from grammar and spelling errors. Responses are honest and thorough.	Clear, concise and free from grammar and spelling errors. Responses are honest and thorough.	1 or 2 questions unanswered	More than 2 questions unanswered

Dear Project Managers:

As is the nature of our industry, our customer requirements have changed. I want to inform you of specific changes to our development of Heorot Homes so your company has an opportunity to revise its bid.

First, the customer wants to install custom shelving along the 12-foot wall adjacent to the doorbell, and has asked for the removal of three 125-volt, 15-amp duplex receptacles.

Second, the customer has asked to add a third 6-inch incandescent canned light in the family room. In addition, the customer wants a single 6-inch incandescent canned light added to the center of the master bedroom.

For your convenience, I have attached an additional copy of the floor plan affected by this change.

Before we can give final consideration to the competitive bids you have submitted, we are asking for you to submit a revision reflecting the customer's requests. We do not require a completely new proposal; a one-page addendum reflecting the changes will suffice.

To receive further consideration, revised bids are due Monday, October 28.

Thank you for your attention to this matter.

Jerry Bandy
President, CEO, Frustration-Dealer
Bandy Building

Written and Oral Communication in the Building Industry

Reading Information 4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text.

Language 4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases

- a. Use context as a clue to the meaning of a word or phrase.
- b. Apply knowledge of Greek, Latin, and Anglo-Saxon roots and affixes to draw inferences concerning the meaning of scientific and mathematical terminology.
- c. Consult specialized reference materials, both print and digital, to determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.
- d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

CTE standards:

D3.0 Interpret and apply information from technical drawings, schedules, and specifications used in the construction trades.

6.11 Comply with energy industry safety procedures and proper ways to perform work

8.2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Energy, Environment, and Utilities industry sector

10.1 Interpret and explain terminology specific to the Energy, Environment, and Utilities sector.

Directions: Use the excerpts from the National Electric Code to answer the following questions. Be sure to quote specific evidence from the NEC to support your responses where required.

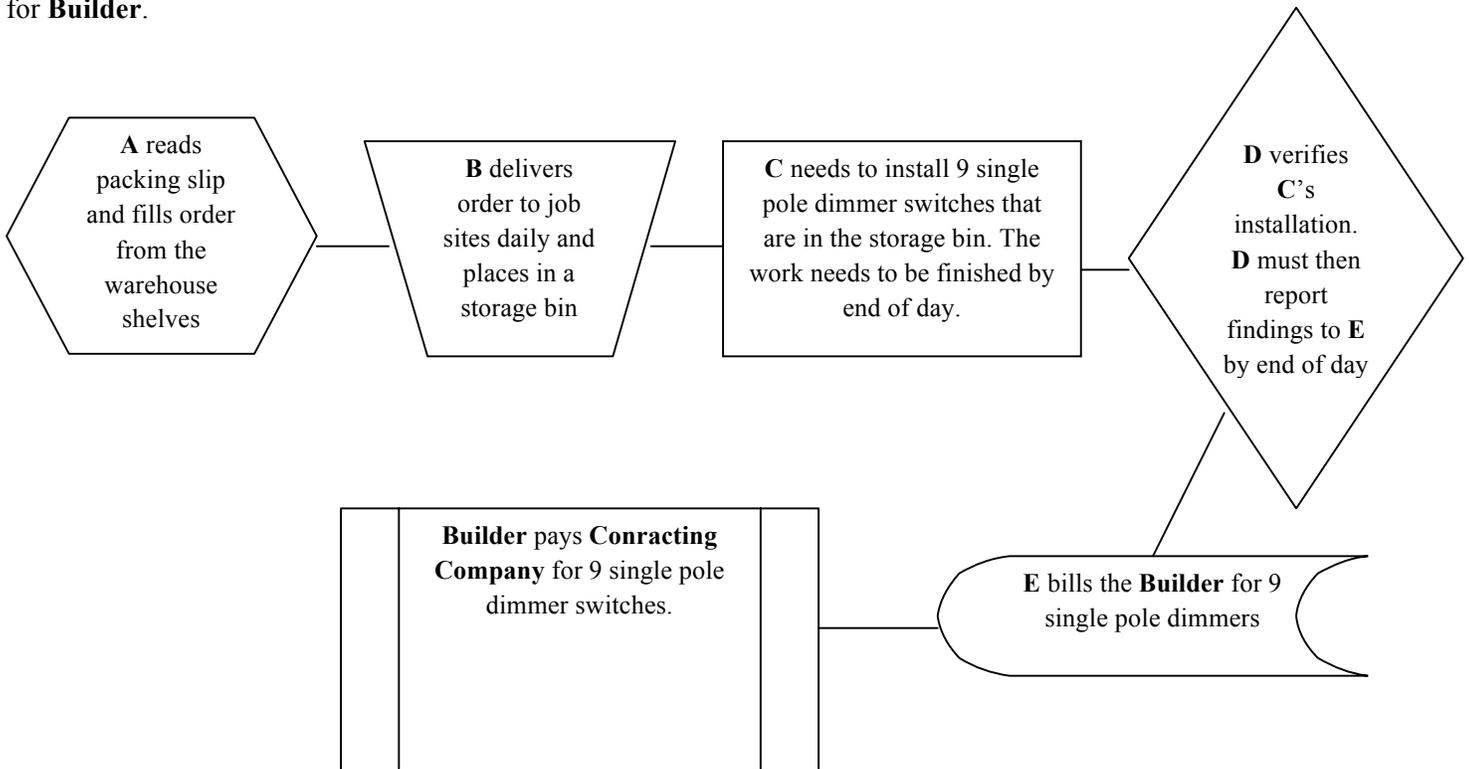
1. Read the definition for *premises wiring*. Concisely explain this term in your own words.
2. The term *receptacle* derives from the Latin *receptāre*, meaning “to receive again.” How does the original Latin meaning of the word relate to its meaning as defined in the National Electric Code?
3. Name three important provisions for the installing and wiring of receptacles in a new home that might affect an electrician’s installation of such receptacles.
4. According to the NEC, which provision disallows lighting to be on the same branch circuits used for small appliances?
5. According to the NEC, can a countertop kitchen receptacle be wired to a single circuit? Why or why not?
6. For aesthetic reasons, a homeowner has asked you, the electrician, to install the kitchen countertop receptacles three feet apart from each other. Can you do this? Why or why not?
7. A homeowner has asked the electrician to install a receptacle adjacent to a bathtub that is 38 inches away from the bathroom sink. According to the NEC, can the electrician do this? Why or why not?
8. What is the minimum number of outdoor receptacles that must be installed in a new home?
9. Review the format of the NEC pages. What is the purpose of the various headings and section numbers? What information does page 19 of the Code Check page reflect from NEC page 70-52?
10. Many students bemoan vocabulary and reading work while in high school. With the above questions in mind, to what extent are vocabulary and reading comprehension skills important in the electrical trade? In the construction industry in general?

Reading a Floor plan

1. Using the codes provided in the NEC excerpts, are the receptacles installed on the east wall of the home compliant with the code?
2. How many switches are wired to control the ceiling fans?
3. Which switch plate controls lighting in three different rooms?
4. Where are the GFI receptacles located?
5. Is it possible by mistake to turn on the ceiling fan instead of the porch light?

Workflow

Review the work flow for employees named **A-E** who work for **Contracting Company** performing electrical installations for **Builder**.



6. Given the above, explain at least three different possible errors that can interrupt this workflow and thereby cause either the **Contracting Company** or the **Builder** to lose time and money during this process.
7. Employee **C** can't install an optional telephone outlet package because it was not included in the original storage bin. What effect does this have on the above workflow?

INVITATION TO BID

October 18, 2013

Your firm is invited to submit a bid for the following project:

HEOROT HOMES

Project Description:

Construction consists of 256 new one and two story 1,700-2,500 sf single-family dwelling-places for Heorot Homes in Elk Grove, California. The homes will contain 3-4 bedrooms, kitchen and dining nook, family/living room, and two bathrooms. Attached garage with optional 2-car capacity available.

Project will meet all federal, state, and municipal building codes.

BID DUE DATES

Bid Package #	Title	Bid Date	Bid Time
1	Foundation	10/07/2013	3:30 PM
2	Framing	10/09/2013	3:30 PM
3	Plumbing	10/21/2013	3:30 PM
4	Electrical	10/24/2013	3:30 PM
5	Drywalling	10/25/2013	3:30 PM
6	Painting	10/25/13	3:30 PM
7	Rough clean	10/28/2013	3:30 PM
8	Painting	10/31/2013	3:30 PM
9	Carpeting	10/31/2013	3:30 PM
10	Finishing	10/31/2013	3:30 PM

Proposals received after the dates and hours listed above will not receive consideration. For the bid packages above, only original proposals will be considered. Faxed proposals or digital proposals will be declared non-responsive and will not receive consideration.

Bid shall include completed and signed proposal with pricing based on required specifications and scopes.

Other requirements to be provided prior to signing the contract:

- Complete copy of your GL Policy or IVF
- Workers' Compensation Insurance with Waiver of Subrogation & EMR Rating - \$1,000,000 each occurrence
- General Liability - \$2,000,000 with Additional Insured Endorsement Form (CG 2010 or equivalent), Primary Clause, Waiver of Transfer Rights of Recovery
- Auto Liability - \$1,000,000 combined single limit
- Current California State Contractor's License
- Quality Statement
- GL Carrier must be rated A- or better by AM Best

YOUR COMPANY, INC
ADDRESS
Elk Grove, CA 95624
(916) 555-5555

To:

Order Form

Ticket:	
Revision:	
Date:	

Project:		Phase:	
Plan:		Lot:	

Part #	Description	Mfg	Mfg Part #	Unit	Quantity
461	DUPLEX RECEPTACLE	P&S	3232TRW	EA	_____
462	G.F.I. RECEPTACLE	P&S	1595TRW	EA	_____
267	SINGLE POLE SWITCH DECO	P&S	TM 870-W	EA	_____
116	3/0 NAIL-ON LIGHT OUTLET	Union	59876	EA	_____
198	HALO 6" INCANDESCENT CAN	Halo	H7-ICAT	EA	_____
199	HALO 26 WATT AIR TIGHT FLUORESCENT CAN	Halo	H272-ICAT	EA	_____
119	4/0 FAN BRACKET/ CEILING FAN	Arlington	FBRS415	EA	_____
465	AirKing AK90 EXHAUST FAN	AirKing	AK90	EA	_____
258	BATTERY BACK-UP SMOKE DETECTOR	BRK	9120B	EA	_____
435	BACKUP BATTER CO2/SMOKE DETECTOR	BRK	SC920B	EA	_____
279	SATIN NICKEL DOOR BELL BUTTON	NuTone	PB43LSN	EA	_____
278	SATIN NICKEL CHIME KIT	NuTone	BK131LSN	EA	_____
269	LIT HOUSE NUMBER, 4" ADDRESS LETTERS	Aerolite	PLHN4	EA	_____
99	1 GANG NAIL ON (23 CUBIC INCH) 220V RECEPTACLE	Allied	P-241	EA	_____
2	200A Meter Main Combo Panel	CutlerHam	MBED3042B2	EA	_____

Communications in the Building Industry
(electrical contracting)

Your group will be writing a proposal that explains what work your company will do for my business and how much it will cost. Your team has a Project Manager, Estimator, Writer, and Editor. The **Estimator's** job is to calculate and double-check all calculations. The **Writer and Editor** will work on most of the written proposal. The **Project Manager**, Estimator, and Editor will revise and double check the math and written work for the whole group. The **Project Manager and Estimator** will be primarily responsible for the oral presentation. The PM also is the only one who communicates with me and explains things to your group.

1. At this point if you haven't finished the reading questions based on the packet, complete them as best you can (we reviewed them in class today).
2. If you haven't reviewed the floor plan and counted the number of electrical items (receptacles, switches, etc.) you need to order, complete that. I've attached the floor plan and worksheet (Take Off Sheet). They are also in the course locker.
3. Your Project Manager will, hopefully, contact you about what to do next. He may give you a list of items whose cost needs to be researched online. For example, he may ask you to find out how much it costs to buy a receptacle or a switch.

Don't worry about being frustrated or confused as this is a built-in part of the process. What will be important is for you to note what specifically confuses you or frustrates you--I'll ask you to write about it when the project is finished.