



Informational Guide

Wiring Guide for Residential Remodels, Additions and Rewiring

In order to wire your own home, you must comply with the requirements of the 2014 edition of the National Electrical Code (NEC). The NEC is **not** intended as a design specification nor is an instruction manual for untrained persons; its purpose is the practical safeguarding of persons and property from hazards arising from the use of electricity. This guideline is written to help the lay person comply with the NEC requirements for single family dwelling units, and is in no way inclusive of all requirements for every installation. **Caution!! Some locally sold wiring materials may not meet the requirements of the NEC.**

Along with meeting NEC requirements, the permit and inspection process defined in the State of Oklahoma Construction Industries Board Title 158, **Chapter 40 and City Ordinance 10-88** must be followed. The electrical inspector will typically make four inspection visits on a residential permit, one for the temp pole, one for the rough-in, one for the service and one for the final inspection. If for some reason the job does **not** meet the requirements of the NEC and additional inspections are necessary, a re-inspection fee may be assessed before the inspector will return.

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1. Service

The service equipment must be large enough to supply the connected load which is calculated using Article 220 of the NEC. The most common sizes of residential service equipment are 100, 125, 150, and 200 amperes. The minimum size wire for service entrance conductors are listed below:

Three Wire, Single Phase Dwelling Services

Conductor Types and Sizes

RHW - THWN - THHN - XHHW - USE

| Copper | Aluminum & Copper-Clad AL | Service Rating In Amps |
|--------|---------------------------|------------------------|
| AWG | AWG | |
| 4 | 2 | 100 |
| 2 | 1/0 | 125 |
| 1 | 2/0 | 150 |
| 2/0 | 4/0 | 200 |

The service equipment must be grounded in accordance with Article 250 of the NEC, which in general says that the neutral must be bonded to the service enclosure and the grounding electrode system defined in 250-28, 250-50, 250-52, 250-53.

The main service equipment panel shall be mounted either outside or inside the dwelling as near as possible to the point of entrance of the service conductors to the building. All electric service equipment including meters and electrical panels shall have a clear area 30" wide and 36" deep in front. This clear area must extend from floor to ceiling with no intrusions from other equipment, cabinets, counters, appliances, etc. Panels are **not** allowed in clothes closets or bathrooms.

In service equipment the neutral and equipment grounding conductors are bonded together. **Note:** In sub-panels the neutral is isolated from the equipment ground.

2. Branch Circuit Wiring

Type NMB cable (a.k.a. romex) is the most widely used wiring method used in residential dwellings. NM cable must have 90 degree conductor insulation rating which is designated on the cable sheath by a "B". Type N.M.-B, #12 shall be used for lighting and receptacle circuits, while #10/2 with ground is commonly used for electric water heaters, #10/3 with ground for electric dryers and cooktops, and #8/3 with ground and #6/3 with ground for ranges and wall mounted ovens. Type "SER" or any four wire cable is required for electrical ranges, cooktops, wall ovens and clothes dryers.

These cables must be protected by overcurrent devices (circuit breakers) which do not exceed their rated ampacity. The rated ampacities for cable types are listed below:

| Copper NM Cable Type |
|----------------------|
| 20 amperes for #12 |
| 20 amperes for #12 |
| 30 amperes for #10 |
| 40 amperes for #8 |
| 50 amperes for #6 |

S.E. and S.E.R aluminum cable may only be used as service conductors or as feeders from service equipment to sub-panels.

It is important to note that if you begin a circuit with #12, you must use this same wire size throughout. You **cannot** mix different wire sizes on the same branch circuit.

Type NM cable must be stapled within 12" of metal boxes, utilizing approved connectors, within 8" of plastic boxes and every 4-1/2 feet thereafter. Proper connectors must be used where NM cable enters metal cabinets or boxes. NM cable must be stapled 1-1/4" back from the nearest edge of the wood member.

3. Required Branch Circuits

(a) Small Appliance Branch Circuits - The NEC requires a minimum of two 20 amp branch circuits to feed receptacle outlets for small appliance loads, including refrigeration equipment in the kitchen, pantry, breakfast room, and dining room. These circuits, whether two or more are used, may have only four outlets each and shall **not** feed anything other than receptacles in these areas. Lighting outlets are not permitted on these circuits.

(b) Laundry Branch Circuit - One 20 amp branch circuit must be provided for the laundry. This circuit is limited to receptacles within the laundry room. No lighting outlets are permitted on this circuit.

(c) A furnace requires a dedicated circuit.

(d) Recommended dedicated circuit (to meet Mfg. Warranty if required) disposal, dishwasher, microwave, and freezer.

(e) All 120 volt circuits shall be 20 ampere rated.

Note: All 125 volt, 20 ampere lighting and outlet branch circuits installed in dwelling unit except bathrooms and garages shall be protected by an Arc-Fault Circuit Interrupter (A.F.C.I) listed to provide protection of the entire branch circuit. This includes wiring to the smoke detector outlets. 210.12, NEC

4. Required Receptacle Outlets

(a) G.F.I. receptacles, in bathrooms, must be on a 20 amp. Circuit and have no other outlets.

(b) At least one GFCI outlet in each car bay of garages with electric power.

(c) At least one GFCI outlet installed outdoors (required in the front and back of house) not

more than 6'- 6" above grade and not more than 25 feet from equipment requiring servicing.

(d) At least one receptacle must be installed in each unfinished basement. All outlets in unfinished basements must be G.F.C.I. protected.

(e) In every kitchen, family room, dining room, living room, parlor, library, den, sunroom, bedroom, recreation room, or similar rooms of dwelling units, receptacle outlets shall be installed so that no point along the floor line in any wall space is more than six feet, measured horizontally, from an outlet in that space including any wall space two feet or more in width and the wall space occupied by sliding panels in exterior walls. The wall space afforded by fixed room dividers, such as free-standing bar-type counters, shall be included in the six foot measurement. No outlet may be installed over electric baseboard heater. **Note: Article 210-52(c) (1) Wall counter space.** A receptacle outlet shall be installed at each wall counter space 12 inches or wider. Receptacle outlets shall be installed so that no point along the wall line is more than 24 inches measured horizontally from a receptacle outlet in that space. (See item 5 (d) below.)

5. Required G.F.C.I. Outlets

All receptacles listed below must be protected by a Ground Fault Circuit Interrupter:

- (a) Bathroom receptacles.
- (b) All outdoor receptacles. (see exceptions Article 210-8 (A))
- (c) Garage receptacles. (see exceptions Article 210-8 (A))
- (d) All kitchen outlets that serve counter tops, including islands.
- (e) Wet bar sinks
- (f) Unfinished basements. (see exceptions Article 210-8 (A))
- (g) Crawl spaces – at or below grade level.

6. Conductor Fill

Outlet and junction boxes shall be of sufficient size to provide free space for all conductors and devices enclosed in the box. All outlet boxes have a specific volume measured in cubic inches. (See Table 314.16(b), NEC). This volume must be equal to or greater than the cubic inches required for the number of conductors and devices in the box.

| Conductor/Device Box Fill | Cubic Inches |
|--|--------------|
| each #12 | 2.25 |
| each #10 | 2.50 |
| each device counts as | 2 |
| Note: Count only one (the largest) ground wire | |

Example:

2 - #12-NM-B cables, one duplex receptacle

$4 \times 2.25 = 9.0$ cu. in.

$1 \times 2.25 = 2.25$ cu. in.

$1 \times 4.50 = 4.5$ cu. in.

NOTE: 15.75 cu. in. minimum box size

7. Equipment Grounding and Conductor Make-up

All equipment grounding conductors must be connected together with solderless pressure connectors, such as wire nuts or crimp sleeves, leaving sufficient extra conductor for attachment to the metal box and/or device. When crimp type connectors are used they must be crimped using the tool recommended by the manufacturer. Please note that **all** metal junction and outlet boxes must be grounded by attaching the equipment grounding conductor out of the NM cable to the metal box using an approved screw or grounding clip. When circuit conductors are made-up, six inches of wire (from face of box) must be left for use in make-up and for the attachment of devices.

8. To Figure Minimum General Lighting/Outlet

Requirements: Reference Table 220.3(A) 2002 N.E.C

One 120 volt 20 amp circuit per 500sq.ft.

Each 20 amp. Circuit @ 80% = 16 amps @ 1.5 amps per light/outlet = maximum 10 allowed

9. Electric Heat Circuitry

Electric heat may be installed on 20, or 30 amp branch circuits. Listed below is the maximum wattage that may be installed on each size branch circuit, all circuits are figured at 240V.

| AMPS | Maximum Wattage |
|------|-----------------|
| 20 | 3,840 |
| 30 | 5,760 |

For example, if you are installing baseboard heaters which are rated 250 watts a linear foot, you could install 15 feet on a 20 amp 240 volt circuit. (250Wx15 = 3,750 watts).

10. Rough-in Inspection

At the time you call for your rough-in inspection you should have all wire pulled, stapled properly, and all splices made up and ready to accept devices and fixtures. Please **do not** install any devices or fixtures or cover any wiring with insulation or wall covering, i.e., drywall or paneling.

11. Electric Service Inspection

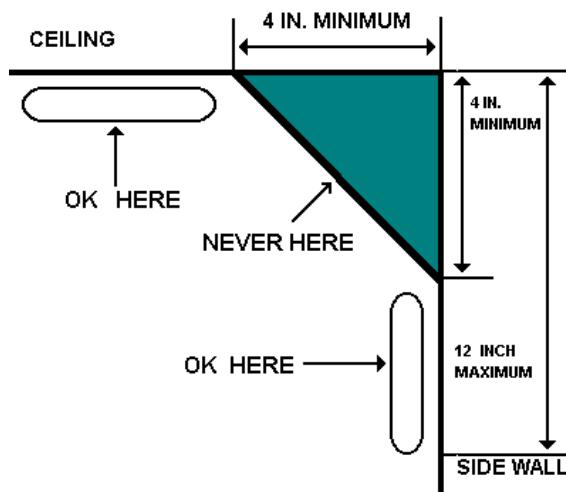
At this time you should have the electric meter, service mast, disconnect and panel installed (electrical panels shall not be located in closets or bathrooms). All wiring shall be properly terminated at the service equipment and electrical panel and all grounding and bonding completed.

12. Final Inspection

The electrical installation should be complete at the time of request including set of permanent meter, service equipment complete and labeled properly. All wiring shall be free from short circuits, ground faults, and open circuits. All light fixtures are required to be grounded along with light switches that are within five feet of a grounded object. All 120 volt circuits shall have power.

13. Smoke Detector Installation

When interior alterations repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be provided with smoke alarms located as required for new dwellings; the smoke alarms shall be interconnected and hardwired. **Smoke alarm locations are as follows:** one in each bedroom; one outside each sleeping area in the immediate vicinity of the bedrooms; one on every habitable level including basements and cellars.



Smoke detectors in existing areas may be battery powered and not interconnected, when hardwiring and interconnection cannot be achieved without disturbing interior finishes.

Exterior repairs to a dwelling requiring a permit do not require smoke detector installation

Have any questions?

If you have questions, please contact the Development Services Department at 405-742-8220 between 8:00am and 5pm Monday through Friday.

Electrical Inspector: 405-880-7032

Combination Residential Inspector: 405-880-7033

Building Official: 405-880-7029