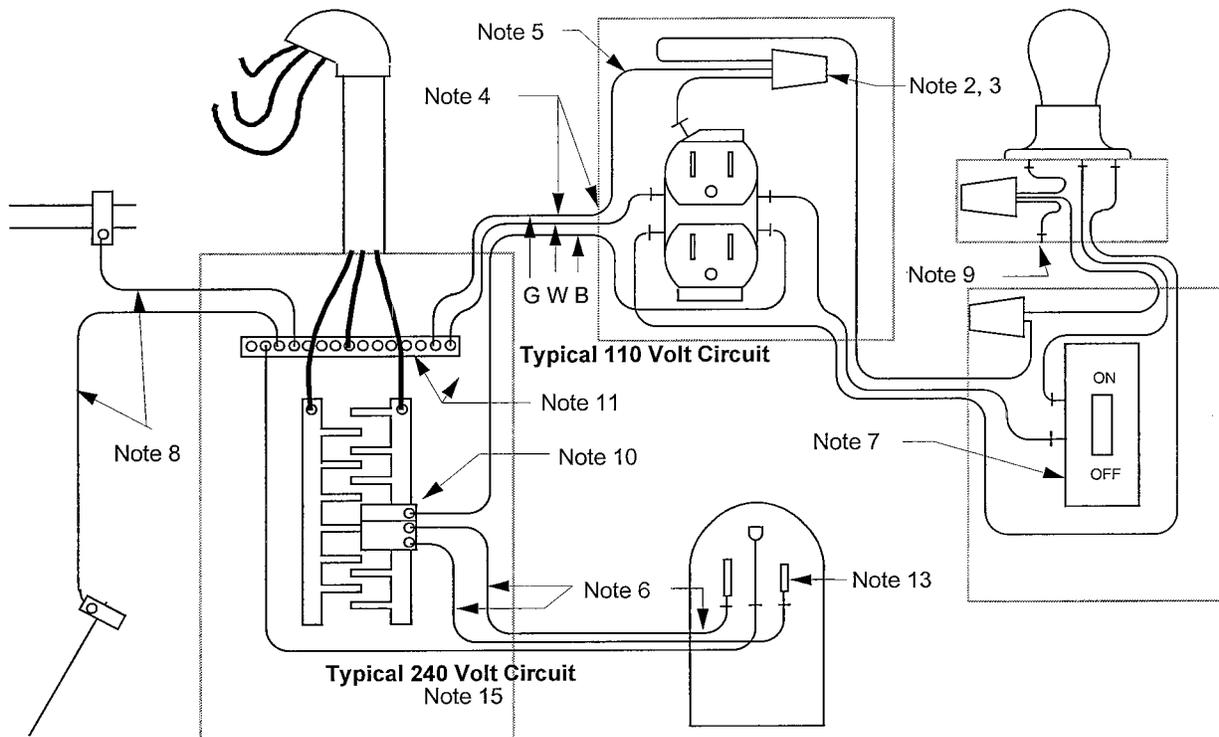




1. This handout is not intended to replace the *CA Electrical Code*<sup>®</sup> (C.E.C.) as adopted. It focuses only on the materials and methods most commonly used in this area for residential wiring. It assumes, for instance, the use of copper non-metallic sheathed cable (romex). It ignores many other alternatives. It is limited to single family residences with services of 200 amps or less, no sub-panels and three stories or less above grade. If more detailed information is needed, the C.E.C. is available in many libraries and may be reviewed at your Building and Safety Department.

2. Use UL approved wire nuts to make up connections. Read the box to see how many wires may be fastened with which size nut. Never use solder.



3. Splice wires only in boxes. All boxes must remain accessible.

4. Secure cable as it exits boxes. Small plastic boxes used only in walls without internal clamps are stapled closer to the box. All others have internal clamps or a clamp must be installed. Staple cable within 8" of boxes that do not have any clamping in or on the box. Staple cable within 12" of boxes with clamps. Staple cable at least every 4 1/2 feet.

5. Leave at least 6" of free conductor inside all boxes. Extend the insulation of the cable into boxes 1/4 inch.

6. Use black or red colored conductors to supply power. Use white for neutrals (grounded conductor) except that you may use #6 and larger in a non-white color and marked with white tape at all boxes. Use green or bare for grounding except that you may use #6 and larger in a non-white color and marked with green tape at all boxes. Where a white wire must be used as a power

supply, wrap it with black tape at all boxes.

7. Install wall switches so that "on" is up.

8. To ground the electrical system proceed as follows: Determine if your house has been provided with a concrete encased electrode sometimes called a "ufer ground". If it has not been provided with a concrete-encased electrode then drive a grounding rod. Create a Grounding Electrode System by bonding (1) metal underground water piping, (2) metal building frame, (3) concrete-encased electrode, and (4) ground ring together wherever any of these are present. Using unspliced wire of appropriate size, ground the system by connecting the neutral buss to the concrete-encased electrode, if present, or to the metal underground water piping. If grounding to metal underground water piping then, using the same wire, also connect the neutral buss to the ground rod. If your house has neither a concrete-encased electrode or metal underground water piping then connect to the ground rod. Also bond interior metal water piping if separated from the underground piping by a meter and metal gas piping. Use approved clamps or fittings at all connections.

9. Using bare or green wire, ground all metal parts of the system. If a switch, fixture, receptacle, appliance frame or other device has a connection point for a ground, use it. Ground metal boxes using a grounding screw in the prethreaded hole in the bottom of the boxes or use a grounding clip. Never be tempted to leave metal parts of the system ungrounded. The grounding wires give stray current someplace to go so that, in the event of an insulation failure, a circuit will be closed and a circuit breaker will do its job and turn off the power. If you do not give the stray current a grounding wire to go through, it may end up going through you.

10. Wires are sized in accordance with the power requirements of the appliance being run. Size circuit breakers to protect wires and prevent them from starting fires in walls. Check the nameplate on the appliance and read the installation instructions for wiring requirements. Never connect a wire to a circuit breaker that is rated at a higher amperage than the wire. Never.

11. Connect the service enclosure box to the neutral buss. (Install the "main bonding jumper".) This is usually done with a special screw that comes with the box in a little plastic bag. Read the directions that come with the equipment.

12. Ranges, cooktops, ovens, and clothes dryers run on 220 volt power but often have components such as lights and timers that use 110 volt power. Such appliances must have a circuit that includes a neutral (white) conductor even though 220 volt power does not use a neutral. Cooking appliances and clothes dryers may, however, use the neutral (white) conductor as both a neutral for the 110 volt power they need and as a ground. Most of them are set up this way. You may use a three-wire (romex) cable without a grounding wire for these appliances but you must use a cable whose insulated neutral (white) wire is at least #10 copper and you must run a dedicated circuit all the way to the service.

Certain appliances such as water heaters use exclusively 220 volt power and have no need for a neutral (white) wire. For such appliance you will probably be using a "two-wire plus ground" (romex) cable. The bare or green grounding wire is used to ground the frame of the appliance. One of the insulated wires used to supply power will probably be white. See note number 6.

13. Plugs and receptacles have different styles depending on the voltage and amperage of the circuit. Read the label and use only the plug style that matches the voltage and amperage of the circuit breaker.

### General Notes of Great Importance.

1. Exposed work: Plastic sheathed cable is obviously protected when it is inside a wall. Greater care must be taken to protect it when it is exposed. Protect such cable from damage wherever necessary by enclosing it in conduit. Protect it with conduit where it sticks through the floor and may be bashed about by brooms. In a garage, run it along recessed surfaces, not draped between studs, joists or rafters. Install running boards across studs or rafters where necessary so that the cable is continuously supported. In basements it may be draped between the joists above but must not be stapled to the bottom of them. Drill holes up in the mid section of the joist or install running boards across the joists.

2. Ground Fault Protection: Install ground fault circuit interrupters protecting all plugs in bathrooms, in garages, outside, in crawl spaces, in unfinished basements and within six feet of a kitchen sink serving counter top appliances. In basements, garages etc., a plug does not have to be protected if it is behind a freezer, furnace or some other large appliance.

3. Protection From Damage: Never install plastic sheathed cable where sharp objects may cut into the insulation. Never allow it to touch unprotected edges of metal boxes, conduit ends, pipe straps, nail ends, sheet metal ducts, etc. Never kink or crimp or otherwise damage the sheathing or insulation on the cable. Protect cable with metal nail plates where it is less than 1 1/4 inches from the face of the stud or rafter. Remember, even minor damage to the cable now can cause a fire or electrocution later on.

4. General: Perhaps more than any other trade, electrical work demands care and attention to detail. A single missing nail is unlikely to cause the collapse of a building but a single badly made up electrical connection can burn it down. If you decide to do your own electrical work make up your mind to buy the proper materials and to take your time and do it right. Every bit of it.