

## 23. Electrical Distribution

The exterior portion of the electrical service was discussed in Section 18. The incoming power passes through main breaker(s) which controls power to the building. From the main breaker(s), power is supplied to distribution boxes which distribute the power to various circuits through current limiting fuses or circuit breakers.

**Older residential services were single phase (two wire, ungrounded) with a voltage rating of 120 volts and current ratings of 60 amperes or less. The earliest system is known as “knob and tube”. Wiring was wrapped around ceramic standoffs (“knobs”) and/or passed through ceramic tubes to isolate wires from wood. Two wire systems had no provision for protection of users in the event of possible hazards from static charges, power surges, insulation aging, etc.. Grounded circuits provide a means for currents to flow safely to the earth. Many older two wire systems have been replaced by three wire (grounded) systems. However, there are older two wire systems which have had three pin receptacles added for the convenience of plugging in appliances with three pin plugs. These receptacles are not grounded. Ungrounded or mis-wired three pin receptacles are hazardous and should be corrected.**

**Most insurance companies will not insure buildings having active knob and tube wiring or current capacities of 60 amperes (or less).**

Most hydro authorities now permit the use of GFCI receptacles (see Section 30) in ungrounded two wire circuits to provide some protection for three pin equipment used under ungrounded conditions. Also, newly built buildings are required to have GFCI protection in kitchen receptacles near sinks, at exterior receptacles and at bathrooms. In addition bedrooms are required to have AFI (arc fault interrupt) protection at receptacles. GFCI protects against shock hazards and AFI protects against possible fires from arcing (sparking).

Modern appliances demand increasing amounts of power, particularly those intended to control heat (stoves, dishwashers, laundry driers, central air conditioners). The present three wire and ground system was adopted in the 1950s and 1960s. The residential standard is 120/240 volts with a current of 100 to 200 amperes. The higher ampere service is required in Northern areas of North America in residences which use electrical power for heating and in Southern areas which have heavy consumption for air conditioning.

The condition of distribution wiring, circuit overload protection, presence or absence of grounding, condition of components (switches, receptacles, etc.) and wiring connections are inspection concerns for safety reasons. Much of the wiring is concealed and conditions cannot be fully determined in the course of a normal visual inspection. Older wiring or wiring which appears to have been installed in a non-standard way should receive more extensive investigation by a certified electrician.

Houses built in the 1960s and 1970s may contain aluminum wire. Aluminum wire is softer than copper. It also has a different resistance to current flow and different expansion/contraction characteristics. When different metals are in contact, a galvanic reaction can occur which causes the junction area to erode, crack and harden. Aluminum wiring must have aluminum compatible terminations to reduce risk of these conditions. The wire is soft and “creep” at connection points may occur. In addition, aluminum oxide, an insulator (copper oxide is a conductor), can interrupt current flow and cause circuit failure. Hardening, cracking and creep over time leads to arcing, overheating and the risk of fire. To reduce these risks special connectors to “pigtail” aluminum wire to copper wire have been developed and oxide preventative coatings have been used. Regular monitoring for heating, blackening, intermittent circuit failure, arcing noises or discoloration at receptacles and switches is recommended. Any suspicious conditions should be checked by a qualified electrician.

# 23. Electrical Distribution

## Main electrical shutoff:

location \_\_\_\_\_

Ganged and fused , resettable current limited

**Service voltage:** 120 , 120/240 , 600

Main conductor amperage rating (approx.) \_\_\_\_\_

Main shut-off amperage rating \_\_\_\_\_

Distribution panel(s) amperage rating \_\_\_\_\_

**Grounding** provided by incoming water line , ground rod/plate , unknown (not observable)

**Service wires:** aluminum , copper , or type not observed

**Distribution box(es):** near main shut-off

Circuits: fused  and/or breakered

Wiring: copper , aluminum  (see highlighted area on opposite page), insulated with cloth , plastic

and/or \_\_\_\_\_

**Wiring type:** Romex , BX , non-metallic insulated , knob and tube

Conditions observed:

(a) **main shut-off:** sealed and not observed , openable without tools , cabinet and/or door (loose , damaged , rusted , water stained , oxidized , burnt or damaged ), burnt or damaged insulation . Ground wire not properly installed  or not fastened to secure ground rod(s)  or \_\_\_\_\_

(b) **distribution box(es):** good condition , cover(s) missing , rusted , insulation burnt/blistered , double wiring , fuses or breakers oversized , disconnected/uncapped wires , breaker(s)  and/or fuse(s)  (burnt , damaged ) or \_\_\_\_\_

(c) **distribution wiring and junction box(es):** good condition , missing (covers , junction boxes , wire connector caps , strain relief bushings ),

boxes loose , wires loose/hanging , insulation damaged

or \_\_\_\_\_

(d) **switches and receptacles:** good condition , covers (missing , damaged ), wires loose , faces blackened , switch operation (seized , loose , intermittent ) in \_\_\_\_\_ room(s)

120 volt wall receptacles three pin  or two pin

Three pin receptacles randomly tested , showed proper wiring and grounding  except in \_\_\_\_\_ room(s) which had \_\_\_\_\_

(e) **GFCI (Ground Fault Current Interrupt) receptacles:** not present , present at: exterior walls , garage interior , bathrooms , kitchen , and \_\_\_\_\_ GFCI operated normally , failed mechanically , failed electrically , or \_\_\_\_\_ in \_\_\_\_\_ room(s) AFCI located in bedrooms  or in \_\_\_\_\_ room(s) Active knob and tube wiring not observed  (see bolded areas on opposite page)

Conditions good  or:

- (a) hazardous and should be corrected on a priority basis
- (b) not high risk but should be corrected to avoid possible problems

Other comments or observations:

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