KNOB AND TUBE WIRING 2

Knob and tube wiring was installed in houses up until about 1950. This system consists or two wires, one **black** or **hot** wire and the other **white** or **neutral** to create a circuit. These two single wires are held in place with ceramic knobs and tubes. Knobs are used to clamp the wire to the structural member, while tubes are placed in holes in the structural members to prevent the wire from chafing.

In modern household wiring, these two wires are bundled together along with a ground wire in a single plastic sheathing cable that runs through holes in the structural members and is held in place with clamps. While knob and tube wiring is not inherently dangerous, it is old, and its insulation may no longer be intact. Much of this wire is concealed behind walls, ceilings and insulation where its condition cannot be completely evaluated.

In addition to the wire covering being deteriorated, these wires are connected by being soldered together and wrapped in electrical tape. After time, this tape either falls off or deteriorates. Knob and tube wiring is usually associated with older installations consisting of 60 amp service. The wire is fused with **15 amps**. Though the wire is **#12 AWG** (American Wire Gauge) from the panel, which is capable of handling 20 amps, some sections of wire may be **#14** gauge handling a maximum of 15 amps. This installation handled a total of 12 circuits, thus the houses have fewer receptacles than modern houses. To prevent fuses from constantly blowing, homeowners put in higher-rated fuses such as 20 or 30 amps! Given that the wire was not intended to carry this additional current, the insulation becomes brittle exposing more wiring, or worse, overheated to the point of causing fires.

Knob and tube wiring does not have a ground conductor. This is identified by two-prong receptacles as opposed to three-pronged receptacles. However, some homes built up until the mid 1960's used sheathed duplex electrical wire with no ground either. A ground conductor is necessary if you are plugging in appliances that have a three-prong plug. Modern receptacles also have one prong slightly larger than the other. This is necessary to prevent reverse polarization. The **black** or **hot** wire is connected to the brass terminal screw while the **white** or **neutral** wire is connected to the silver terminal screw on the receptacle.

LIMITATIONS WITH KNOB AND TUBE WIRING:

- USUALLY RESTRICTED TO A MAXIMUM OF 60 AMP SERVICE
- THE WIRE IS OLD, AND ITS INSULATION MAY NO LONGER BE INTACT
- IT IS NOT A GROUNDED SYSTEM MAKING IT MORE HAZARDOUS THAN MODERN WIRING
- TWO-PRONG RECEPTACLES, RESTRICTING THE USE OF SMALL KITCHEN APPLIANCES

It is quite true that in bedrooms, living rooms, and dining rooms, plugging in a TV or lamp poses very little risk. The opposite is true in areas where you may come in contact with water such as bathroom, kitchens, basements, crawlspaces, and outdoors. An ungrounded system in these areas could be potentially hazardous. In fact, a good building practice across North America is to install GFCI (Ground Fault Circuit Interrupters) receptacles in these areas. Furthermore, newer stereo equipment or computers are affected by incorrect polarization – something that this type of wiring cannot prevent.

SAFETY TIPS:

- NEVER REPLACE BLOWN FUSES WITH LARGER AMP FUSES
- NEVER CUT THE GROUNDING (THIRD) PRONG OFF A PLUG TO FIT INTO A TWO-HOLE RECEPTACLE
- DON'T USE OUTLET MULTIPLIER PLUGS TO CONNECT SEVERAL APPLIANCES OR LAMPS TO ONE RECEPTACLE

Knob and tube wiring, on its own, is not inherently a problem. It becomes a problem when it is abused. If you have such wiring, it would be wise to have the system evaluated by a licensed electrician. If necessary, it should be upgraded to modern wire. Some insurance companies require periodic evaluation.

For further information contact your local public utilities office or a licensed electrician.

GFCI PROTECTION 4

A ground fault circuit interrupter (GFCI) is an electrical device, either a receptacle or circuit breaker, which is designed to protect people from electric shock in a wet or damp environment. GFCI protection should not be confused with grounding. Even if a system is properly grounded, minor faults in a circuit can cause a dangerous shock to a person using an appliance in a damp location or near water.

The GFCI senses the flow of electricity through a circuit. If more current is flowing through the **black**, or **hot** wire than the **white** or **neutral** wire, there is a current leakage (a "ground fault"). The GFCI can detect a leakage as little as **five thousands of an amp** (.005 amps), which will shut off the current in $^1/_{40}$ of a second to prevent injury.

WHERE TO LOOK FOR GFCI PROTECTION:

- ALL OUTDOOR RECEPTACLES THAT ARE WITHIN SIX FEET OF THE GROUND
- RECEPTACLES AT HOT TUBS, SPAS AND AROUND SWIMMING POOLS
- RECEPTACLES AND SUPPLIES FOR FOUNTAIN OR POOL PUMPS AND RELATED EQUIPMENT
- ALL BATHROOM RECEPTACLES
- RECEPTACLES WITHIN SIX FEET OF THE KITCHEN SINK, WET BARS AND LAUNDRY TUBS
- AT LEAST ONE RECEPTACLE IN THE BASEMENT AND CRAWL SPACES
- ALL RECEPTACLES IN THE GARAGE (EXCEPT ONE MARKED FOR FREEZER)
- ALL LIGHTING IN HIGH-RISK AREAS SUCH AS WET BARS, BATHTUBS, SPAS, SAUNAS, OR SHOWERS

If you have GFCI receptacles, it is recommended that you test (and reset) them monthly. On a GFCI receptacle when you push the TEST button, the RESET button should pop out, hence shutting off the circuit. Or you can use a **GFCI tester/analyzer**, available at most hardware stores to perform the same test. There is a button on the **tester/analyzer** that should trip the circuit within a couple of seconds and the RESET button should pop out.

The GFCI receptacle contains a resistor connecting the LOAD side of the hot wire to the LINE side of the neutral wire. When you press the TEST button, current through this resistor shows up as an imbalance and trips the GFCI. However, failure of the GFCI to trip in response to a **tester/analyzer** may or may not indicate a real defect. There may be an absence of ground, and the **tester/analyzer** does not trip the circuit. The absence of ground has no effect on the operation of the GFCI. The device should work if there is a *real* short to ground. That is why GFCI receptacles are also used in ungrounded circuits such as KNOB and TUBE wiring.

The same procedure should be done with a GFCI breaker. The GFCI will be located in the distribution or service panel. The breaker can be identified by a TEST button in addition to the breaker switch. Press the TEST button and the breaker switch should trip. Switch the breaker back to the ON position. Do this once a month – breakers have a tendency to stick, and may not protect you when needed.

If you have a GFCI breaker you should also use the **tester/analyzer** to test the receptacles in the vulnerable areas listed above. Note that the receptacle may appear like a normal receptacle without any TEST or RESET buttons, but may be protected in the circuit by the GFCI breaker. Remember to reset the breaker to the ON position after the **tester/analyzer** has tripped the breaker. It is mandatory that receptacles be label if protected by GFCI but ungrounded.

If a grounded GFCI does not trip with a **tester/analyzer**, or if an ungrounded GFCI receptacle does not trip with its own built in buttons, it is probably defective or miswired. Again, if the TEST button on the receptacle or breaker does not work, something is broken and potentially dangerous. The problem should be corrected immediately.

If your house does not have GFCI protection, an electrician can add it. This is an important safety improvement. Electrical wiring and device installation should be handled by a licensed electrician.

For further information contact your local public utilities office or a licensed electrician.

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