

# Knob and tube wiring

Knob and tube wiring can be presumed to be the original electrical wiring in the home, is generally considered old and outdated by modern safety standards, and is inherently difficult to work with because of its design. It's the age of the system that generally creates most problems because many service professionals don't understand how a knob and tube system is designed to work, and they improperly splice or otherwise damage the system.

Knob and tube wiring gets its name from its design, using porcelain or ceramic tubes to protect electric wires that run through lumber framing and knobs to hold the wires when they run along or next to lumber framing (see Figure 1, Figure 2 and Figure 3). The connections for knob and tube wiring are open and visible, and the wires typically are spliced and connected with fibrous electrical tape.

Knob and tube wiring was used up until shortly after World War II. **IF** it was installed properly, **IF** the insulation is in good condition, and **IF** it has not been abused by excessive splicing and connections, it can provide many more years of reliable service (however, home insurance companies don't like it). It is the wiring that has been abused and damaged that is the potential hazard. Any home with active knob and tube wiring should be examined in its entirety by a licensed electrician familiar and experienced with working with older electrical systems.

In a modern system, there are three wires: a hot, a neutral, and a ground. The term "neutral" is a misnomer since there is nothing neutral about it. Electricity comes into the house on the hot wire and leaves on the neutral wire. A properly designed and properly operating electrical system must return electricity to where it came from (and we wonder why the electric company charges us for electricity if they get it all back!). If the electricity can't get back to where it came from, then it will try to go to the ground, hence the name for the ground wire. If there is no ground wire, then people and appliances provide a pathway to the ground if there is a short in an appliance or a problem with the electrical system. Electricity traveling to the ground through people is never a good idea. Since a knob and tube system has only two wires, meaning that there is no ground wire, it is difficult to splice into properly with modern wires that do include a ground. In modern electrical wires, there are actually three smaller wires inside of the large wire you see, whereas in a knob and tube system, the smaller wires are exposed. Consequently, it is easier to damage the knob and tube system, possibly resulting in electrical hot spots, arcing, and fires.

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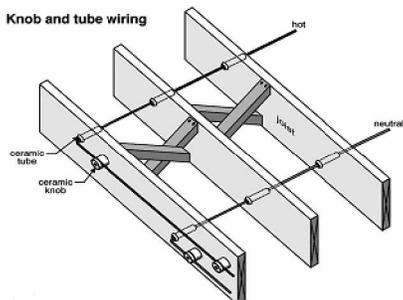


Figure 1. Design of a knob and tube wiring system.



Figure 2. Knob and tube wiring.



Figure 3. Close-up of porcelain knobs.

Since electrical wires get hot due to the resistance of the electrons flowing through the wire, a knob and tube system requires adequate clearance around it—good ventilation—in order to dissipate the heat that is inherent in electrical wiring, so it is not designed to be covered with any material such as the modern insulation that we put in our attics. This often happens when we have insulation added to the attics in older homes (see Figure 4) or when the attic or foundation crawl space is used for storage. Older wiring was specifically installed in open spaces so that it would stay cool. The insulation on the wires is rubber or cloth that melts or burns at a relatively low temperature, so if the wires are covered by insulation other than the wire insulation itself, the wires could heat up enough to burn. Unfortunately, since a knob and tube wiring indicates an older system, the insulation on the wires probably is brittle and might even be missing or damaged in some areas, especially if wildlife have intruded into the attic or foundation crawl spaces where most knob and tube wiring is located. Additionally, the insulation installers themselves typically are not familiar with the design of older electrical systems.

Many modern appliances have a three-prong plug, and modern electric outlets have three slots: a short vertical one that indicates the hot wire, a tall vertical one that indicates the neutral wire, and a round one that indicates the ground wire (see Figure 5). A ground wire is necessary if you are plugging in appliances that have three prongs in the cord's plug. The three-to-two prong adaptors that are sold at grocery stores and home improvement stores bypass the ground safety circuit and should not be used under any circumstances, particularly for computers and plasma televisions. Without a ground, you're putting yourself and your equipment at risk.

Years of experience and, unfortunately, property damage, personal injury, and even deaths have resulted in increased knowledge about electrical systems, knowledge that indicates that a three-wire system with a ground wire currently is the safest.

Recommend further evaluation by licensed electrician before close of escrow. Recommend contacting preferred insurance company before close of escrow to ensure that appropriate homeowner's insurance can be obtained on the structure if active knob and tube wiring is present.



Figure 4. Attic insulation covering knob and tube wires.

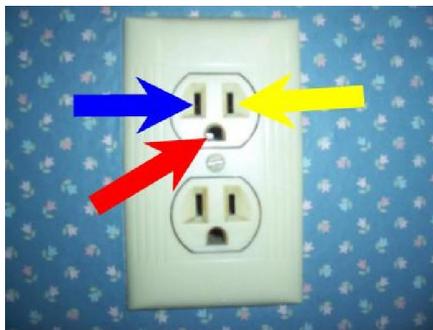


Figure 5. Modern electric outlet showing slots for hot (yellow), neutral (blue), and ground (red) wires.