

Knob-and-Tube Wiring: A Revisit

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Not much has changed in terms of a home inspector's approach to knob-and-tube wiring. The National Electrical Code still states that concealed knob-and-tube wiring can be installed only for extensions of existing installations. In other words, brand new installations of knob-and-tube wiring are not permitted.

The bigger issue, it appears, is the insurance companies' attitude toward knob-and-tube wiring. Many of them don't have a good understanding of it and often withdraw coverage for homes that still contain this wiring, simply because it is old. It's important for you to stay updated about what the insurance requirements are in your area of business so that you can provide the right advice to your clients.

Most of the problems with respect to panels and wiring also apply to knob-and-tube systems. Some issues are more common, however, with knob-and-tube wiring.

Identifying Knob-and-Tube Wiring

Knob-and-tube wiring is easy to identify. There are two separate cables running to each electrical point. There is a black cable and a white cable. Sometimes the sheathing is black on one and white on the other, although this isn't always the case. The ceramic knobs and tubes used to support the wire also clearly identify this kind of wiring. Knob-and-tube wiring was common until 1950 and was used into the 1960s in some areas. Knob-and-tube wire was made in several gauges. Branch circuit wiring was often 12 gauge. Remember that, with knob-and-tube wiring, there will be no

original equipment ground wires anywhere in the distribution system. Often, original connections are not in junction boxes. Connections are made by splicing, soldering and taping the wires. Knob-and-tube wiring was no longer used by the time multiwire branch circuits were introduced.



Ceramic tubes can be seen going through the joists and the knobs can be seen in the background. The hot and neutral wire have been damaged.

Common Conditions Related to Knob-And-Tube Wiring

Problems specific to knob-and-tube wiring include the following:

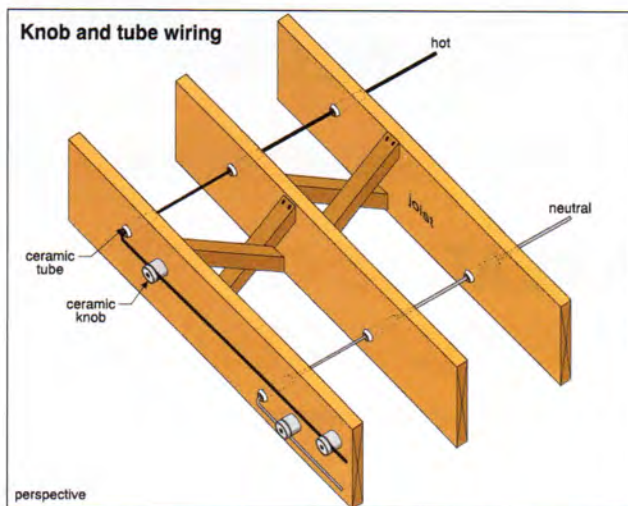
- Connections not in boxes
- Brittle wire, insulation or sheathing
- Wire buried in insulation
- Fused neutrals

Connections not in Boxes

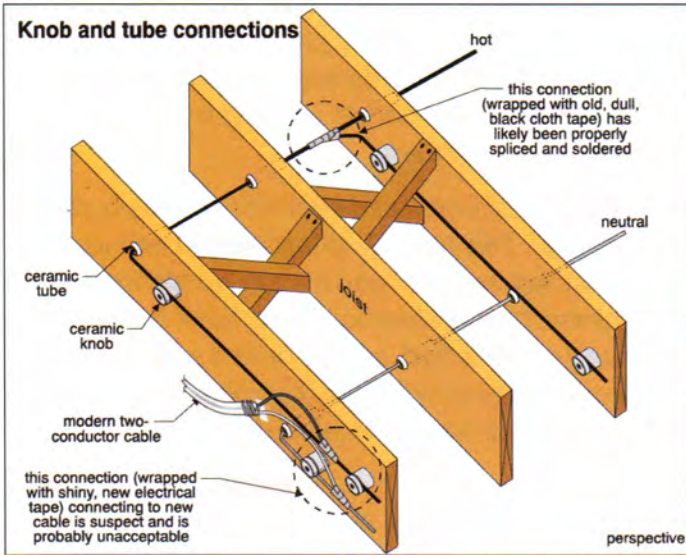
The original spliced connections did not have to be in junction boxes. This is acceptable as long as the connections are original because we have some confidence that the splices are appropriately made by twisting the wires together, then properly soldering and finally taping with the old, dull, black cloth tape.



Although these circuits are obsolete, the original connections that were made with the dull black cloth were correct.



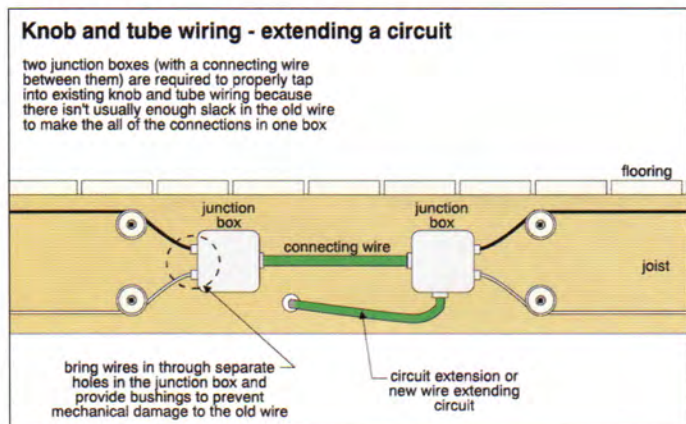
Modern plastic electrical tape (the black, shiny stuff) on a knob-and-tube connection, or taped connections with knob-and-tube wiring joining modern two-conductor cable, are not acceptable to most authorities. The only knob-and-tube connections that don't have to be in junction boxes are the original ones. Knob-and-tube wire should join modern two-conductor cable in a junction box.



Old wire can easily be identified with the removal of cover plates; however, we don't recommend pulling the outlet out of the box.



Here is an incorrect connection with newer wiring and the shiny black tape. This should be in a junction box.



Brittle Wire, Insulation or Sheathing

Old wire. Another issue with knob-and-tube wiring is the age of the wire. Although copper does not fail under normal workloads, a house wiring system that's been around for a long time may well have been overfused at some time in the past and the wire may have been overworked. The older it is, the more likely it is to have been abused at some point.

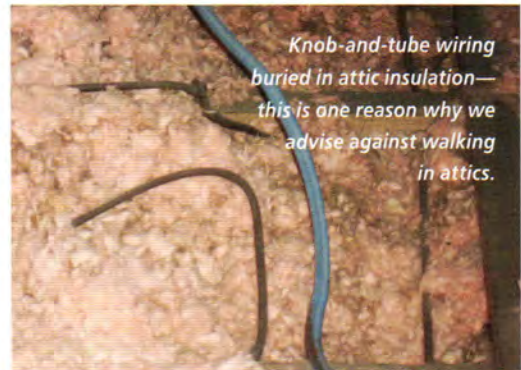
Insulation and sheathing. The rubber insulation or the cloth sheathing may deteriorate over time, become brittle and start to fall off. This is a function of age and high temperatures. The high temperatures may be high ambient temperatures or due to over-fusing. In either case, watch for insulation problems on knob-and-tube wiring. Resist the temptation to flex the wire to see if it's still supple. You may get a shock or damage the wire.

Problems with the sheathing and insulation are the most common failings of knob-and-tube wiring other than amateurish modifications and extensions of the circuits.

Wire Buried in Insulation

Hard to Dissipate Heat. Knob-and-tube wiring buried in attic insulation or in wall insulation is a controversial issue and different authorities have taken different positions. Some maintain that knob-and-tube wiring shouldn't be buried in insulation because that inhibits its ability to dissipate heat.

It's true that all wire can work more comfortably if it's able to dissipate the heat generated as electricity flows through it; however, there is a counterpoint position.



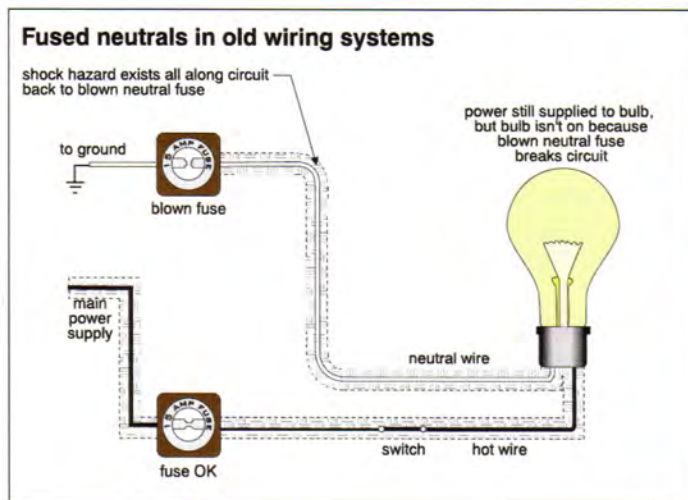
Separate wires may be an advantage. Because black and white wires are usually separated by several inches in different cables, knob-and-tube wiring might be better able to dissipate heat than modern cable. Modern two-conductor cable has the black wire and white wire less than one-quarter of an inch apart inside a plastic sheathing. It is harder for modern cable to dissipate heat than for knob-and-tube wiring. This is probably only an issue in situations where several cables are bundled together and there is heavy continuous loading on each cable.

Nonetheless, you should find out what is accepted practice in your area. In some jurisdictions, knob-and-tube wiring is only permitted in insulation if the insulation is noncombustible. Find out what your authorities consider “noncombustible.” Some consider fiberglass insulation combustible (it really is at certain temperatures).

Insulations made of cellulose, wood shavings, shaved leather, most plastics and other similar materials are combustible. Insulations made from vermiculite, gypsum slag and asbestos are not combustible (although asbestos is associated with other issues).

Fused Neutrals

Because knob-and-tube installations are old, they may connect to old panels. Some of these old panels have fused neutrals, which can be dangerous.



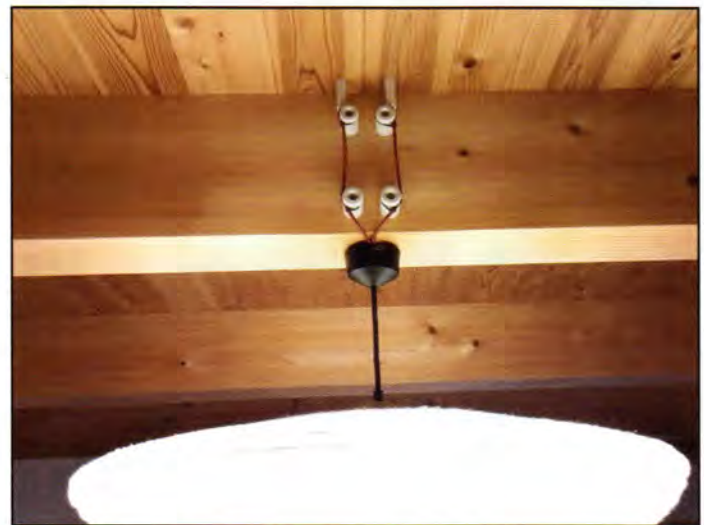
When you see knob-and-tube wiring and an old ceramic panel, look for fused neutrals. (We mentioned these earlier in this article when we described problems in panels.) If the neutral wire and hot wire are both fused, only one is likely to blow, shutting off the circuit. If the neutral fuse blows, the circuit is live through its entire length. This is dangerous for anyone working on the circuit. Recommend the replacement of panels with fused neutrals.

A Final Word on Knob-and-Tube Wiring

It's important to remember that knob-and-tube wiring itself is not inherently dangerous. Indeed, there is no grounding, but there are many other types of wiring without grounding as well, such as many multiwire circuits used from the 1940s through the 1960s. In many jurisdictions, there are solutions to the grounding issue, such as adding GFCI outlets for each circuit, without having to rewire the entire system.

The real issue of knob-and-tube wiring simply comes down to age. This type of wiring hasn't been used in new construction for a long time in North America, and any existing installations may have been overfused and overworked, as mentioned earlier. Again, you should find out what is acceptable in your area, both in terms of the electrical authority and home insurers.

In some other countries, the use of knob-and-tube wiring is still an acceptable practice, and proper installations are not a problem when completed according to local building codes.



Here's a knob-and-tube installation (fewer than 10 years old) for a lighting fixture in a home in Japan.

The information provided here was excerpted from the ASHI@HOME training program. The training program gives home inspectors the opportunity to obtain more detailed information on knob-and-tube wiring and other electrical systems. 