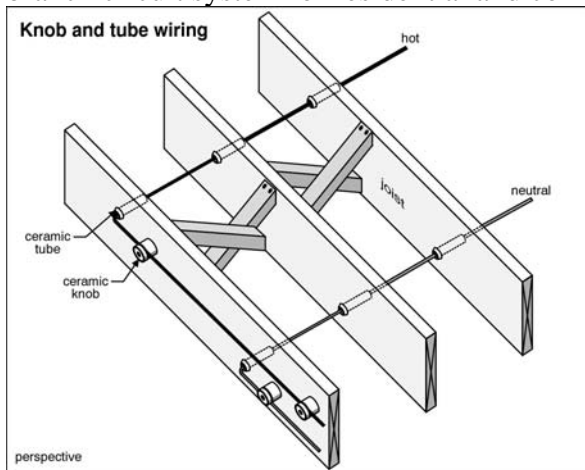




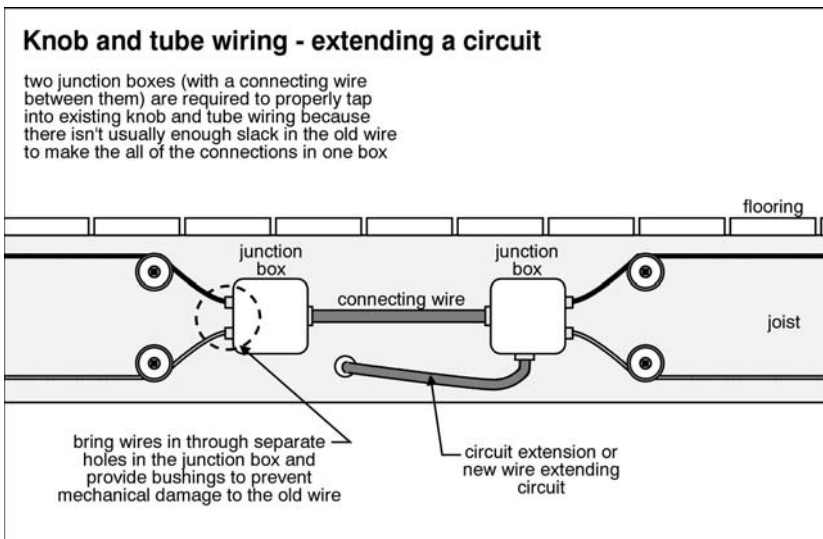
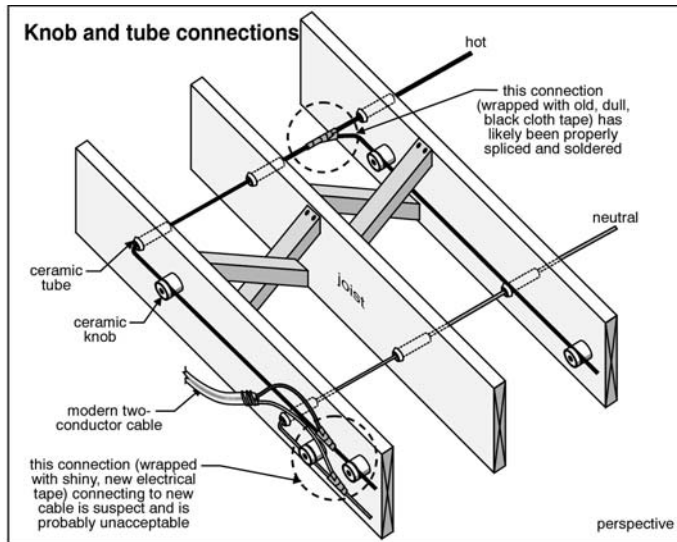
GLOBAL PROPERTY INSPECTIONS  
TECHNICAL BULLETIN  
December 1, 2002

TOPIC: Two-wire, Three-wire circuits, Grounding, and GFCI Protection

**History:** Two-wire branch wiring and circuitry can be traced as far back as the 1800's according to the NEC (National Electric Code), more commonly known as “knob and tube” wiring. This type of circuitry is technically considered to be the beginning of incorporation of a two-wire branch circuit system for residential and commercial wiring.



Knob and tube wiring consisted of a hot and neutral wire with a two to three foot separation distance between the wires, along with ceramic insulators that were installed at bends and contact points to protect the wire from coming in contact with the structural building components of the home. There was and is **NO ground wire** present in these older types of branch circuit systems. Whenever splices or change in direction of wire run occurred, the NEC recommended that a proper splice “insulation material should be stripped back far enough to bare wire to allow one end of the bare wire to be wrapped around the connection point, soldered the connection and wrap the connection with a cloth type electricians tape.” **NOTE: this is the ONLY type of open splice that was allowed in connecting knob and tube to knob and tube connections. According to the NEC all splice connections regardless of type of wire MUST be made in a junction box with appropriate connectors, junction boxes and covers.**



Above is an example for the correct method of splicing knob and tube wiring with modern day Romex wiring.

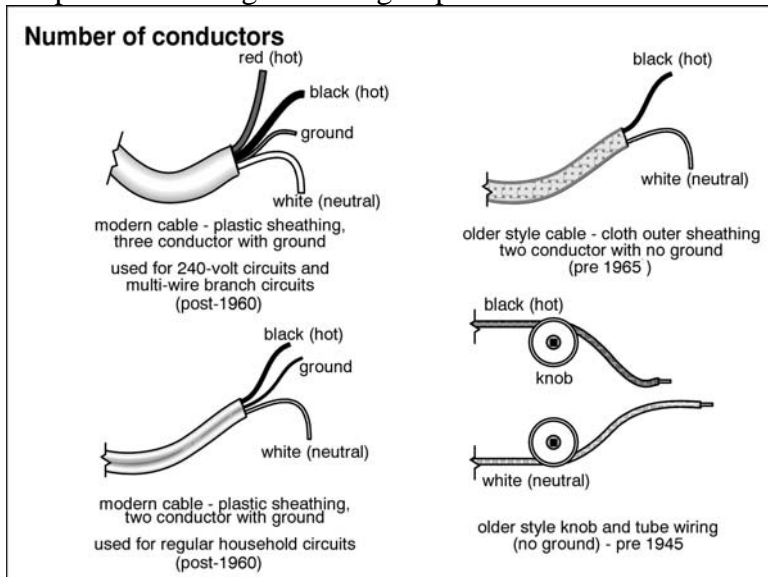
**INSPECTORS NOTE: If a property contains knob and tube wiring (50 + years of age and older) it is recommended to have a QUALIFIED electrician further inspect and evaluate the presence and condition and make any recommendations for repair or replacement.**

In the late 40's up until the early 60's knob and tube wiring converged into a "cloth wrapped" wire (like modern day Romex) that still contained two wires. This type of wiring still did not contain a ground wire. It did however make it less labor intensive to install branch circuits into a property.

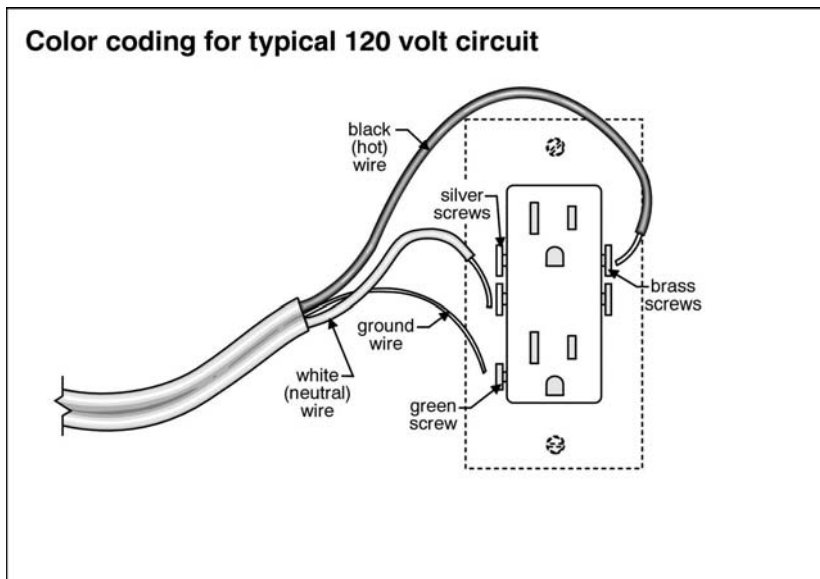
### Three-wire Branch Circuits

In the early 60's Romex wire was introduced to the electrical industry that contained a hot, neutral and a ground wire. The hot and neutral wires are individually wrapped with an individual plastic insulator (ground wire wrapped in paper), all incased in a continuous plastic

wrap to form a single bound group of wires.



Hot wires are typically covered with black plastic, white wires are white plastic and when making a connection to a grounded receptacle or running single strand wire, should be incased in green plastic or connected to a green terminal of a light fixture or receptacle.



With a properly wired branch circuit to a receptacle the black wire (hot) connects to the brass screw connector of the receptacle, the white (neutral) connects the silver screw. Green wire (ground) connects to the green screw connector. Notice to that the neutral side of the receptacle has a wider slot. This is to accept the more modern day polarized plugs. When properly wired in this manner, there is less or no possibility of creating a “reversed polarity” outlet.

### Inspecting two-wire and three-wire branched circuits

Often times when inspecting older homes that still have the older two-wire systems, inspectors have found someone has substituted a three-prong receptacle (hot, neutral, and ground) in place of a two-pronged receptacle to allow the capability of plugging in polarized plugs and three-

pronged plugs. **THIS IS A DEFECTIVE OUTLET!!** The recommendation from the inspector should be to have a qualified licensed electrician make the appropriate call for repair or replacement of the circuit.

In the past I have made the recommendation to re-install a two-pronged receptacle or even a GFCI receptacle to solve the problem or re-wire the branch circuit to accommodate an appropriate ground. GFCI's can be installed on older two-wire circuits. Whenever remodeling or rewiring of a home occurs, most jurisdictions will require that any upgrades be incorporated to what the current standards or codes state. Therefore **FIND AND REPORT THE DEFECTS AND LET THE LICENSED CERTIFIED ELECTRICIANS MAKE THE CALL!!!**

**This Technical Bulletin has been drafted to be general in nature and not technically exhaustive**