Power Check

Experts in Old Home Electrical Safety

Electrical Fire Risks in Older Homes

Abridged edition

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1. Introduction

"Between 2004 and 2017, there were a total of 28,160 residential fire incidents in British Columbia [an average of 2166 per year]; of which, 2,635 (9.4%) were electrical fires. These electrical fires resulted in a total of 150 casualties (combined deaths and injuries) and just over $150 million in damages."[1]

Electrical fires in residential buildings are no less prevalent today. In British Columbia, in 2022 there were 2,433 residential structure fires reported, including 49 deaths. Approximately 10% stem from an electrical fault. The source of the fault can be from the house electrical system, an electrical appliance, electric heat or other. Here are the stats for the year 2022 from BC Office of Fire Commissioner:[2]

- Electrical distribution equipment: 180 (7.4%)
- Appliances and equipment: 116 (4.8%)
- Heating equipment (incl. water heater, baseboard heat, portable space heater, central heating unit. Electricity or fuel type not specified): 183 (7.5%)
- Other electrical equipment: 69 (2.8%)

Also note: After a fire incident the source of the fire can not always be determined. In 2022 source of fire was not determined in 510 (21%) residential structure fires. A portion of these fires could be attributed to an electrical fault.

It is important to note that the vast majority of these fires could have been prevented had the concerns been identified in advance.

It is important to note that the vast majority of these fires could have been prevented had the concerns been identified in advance. An electrical checkup conducted periodically of the home is the homeowners best action to identifying any concerns in advance. The recommended person to conduct the examination is a "Master Electrician" (a title issued by Technical Safety BC) with expertise in older homes. To be accurate the checkup must be thorough, looking at all aspects of the electrical system in the home; not just the the "knob and tube", "aluminum wiring", or "size of service". PowerCheck provides this service and sums up the findings by describing the houses with a risk rating, Low, Medium, High or Extreme Risk; along with steps to bring the house to Low Risk.

1 Zheng, A. et al., The Influence of Electrical Fires in Residential Homes, BC Injury Research and Prevention Unit and the University of the Fraser Valley, 2019

2 BC Office of Fire Commissioner, 2022 Annual Report

Numerous studies have shown that the leading cause of electrical fires in homes is due to "handyman tinkering".

2. The Leading Causes of Residential Electrical Fires

"Knob-and-tube" wiring, "60-amp electrical services" and "fuse boxes" have been singled out by the insurance industry as being the "red flags" of older homes with high potential risk of electrical fires. Surprisingly, these wiring system components are not usually the culprits of electrical fires, nor are they the best indicators of electrical fire hazards being present in a home. The truth is, even though it may be old and well used, provided that an original electrical system has not been abused it will likely be in excellent condition today. So, when we focus our attention on older wiring and fuse boxes as the prime suspects, we often miss the true hazards.

Numerous studies have shown that the leading cause of electrical fires in homes is due to "handyman tinkering". This is the situation whereby an inexperienced homeowner or an otherwise unauthorized individual has made changes to an original electrical system that are not in compliance with the electrical code.[4] The phenomenon of handyman tinkering first became widespread in the 1960s as the trend towards do-it-yourself home renovations emerged, and the widespread building of basement suites.

There are many under the radar secondary suites that go uninspected and often do not meet safety standards.

"Secondary suites are becoming more common as a way to relieve the burden of rising housing prices in British Columbia and basements are often converted for this purpose. However, home owners often circumvent the permission and inspection requirements for these conversions in order to save on expensive upgrades for compliance. As a result, there are many under the radar secondary suites that go uninspected and often do not meet safety standards."[3]

3. Knob-and-Tube Wiring

The knob and tube wiring in older houses is usually found to be in fine shape in older houses. Their are concerns that need to be checked. The key concern with knob and tube is not the knob-and-tube wiring itself, but lack of grounding of outlets. If the wiring is sound, which it usually is, modern GFCI receptacles can be provided to these circuits inexpensively, providing the necessary ground protection to the outlets without the

3 Zheng, A. et an., ,The Influence of Electrical Fires in Residential Homes, BC Injury Research and Prevention Unit and the University of the Fraser Valley, 2019

expense of rewiring. The cost to replace knob-and-tube wiring can be the range of $10,000 per floor, whereas the cost of providing GFCI protection to knob-and-tube wiring in a house is typically less than $1000. We find that replacing knob-and-tube is rarely required to bring the home to be in compliance with today's electrical code.

Knob and tube wiring was the standard wiring in all homes built before 1950. It was used for the wiring of all outlets and ceiling lights. In nearly all older homes, built pre-1950 it is still present and active today. Homeowners may state and believe that the knob and tube has been removed. However in most of these homes the knob and tube remains supplying power to the ceiling lighting. Eliminating knob and tube from ceiling lighting often requires major renovation.

In every house original 2-prong outlets had been replaced with modern 3-prong, giving the false impression that the outlets were grounded.

4. Knob-and-Tube Risk

Since the start of PowerCheck in 2006, PowerCheck has conducted close to 10,000 electrical risk assessments in BC. Looking through the reports the statistics remain consistent from year to year.

- **Knob and tube presence**
  In 99% of houses built pre-1950 the knob and tube was present and active. Homeowners were often not aware that live knob and tube was present in the house.

- **Knob and tube condition**
  In 99% of the houses the knob and tube was in fine shape and did not need replacing. However in every house original 2-prong outlets had been replaced with modern 3-prong, giving the false impression that the outlets were grounded, when they were not, creating an electrical hazard. In houses where 2-prong outlets remained, they were invariably well worn out, requiring replacement. Replacement to both of these scenarios with GFCI-type outlets is an excellent solution.

- **Risk of pre-1950 houses**
  In 99% of houses built pre-1950 some degree of electrical fire hazards were present, independent of knob and tube; the usual culprit being add-ons installed hazardously. Hazardous add-ons ranged from outdoor add-on sensor lights, extension cords running through doorways and walls, outlets and lights installed without junction boxes, overloaded circuits in the kitchen, oversized circuit breakers, loose electrical connections… the list goes on and on.

- **Expected cost to bring house to acceptable level of safety**
  In 99% of houses the expected time to carry out the repairs outlined in the PowerCheck report to bring a house to an acceptable level of safety (what PowerCheck calls, "Medium Risk") is a day with a licensed electrical contractor. Expected cost would typically be in the range of $1000 to $1500. Though a considerable expense for many homeowners, the cost is considerably less than knob and tube replacement, that may not be necessary. More importantly the cost focuses on addressing the real electrical concerns throughout the home.

5. 60-Amp Service

In 1972 the code added a rule for new house construction that if the floor area (excluding basement floor area) is 80 square meters (861 square feet) or more... the minimum service to be installed must be 100 amps.

"Service size" refers to the amount of electricity that can be supplied to a home. Until the 1970s, 60-amp electrical service was the standard in the majority of homes. Correct service size is determined from a calculation called a "Demand Calculation", carried out by an electrical contractor. The demand calculation procedure is laid out in the Canadian Electrical Code[4]. This calculation determines the minimum size of electrical service that is acceptable in a home.

In the 1970s, with the surge of 'baby boomers' looking for accommodation many homeowners converted their unfinished basement, or rec room into a basement suite. To accommodate the potential increase in power that would be required to meet this possible new demand for the basement suite, or electric space heating, in 1972 the code added a rule for new house construction that if the floor area (excluding basement floor area) is 80 square meters (861 square feet) or more, regardless if the calculated service size is 60 amps or less, the minimum service to be installed must be 100 amps.

This rule was essentially a smart service for the homeowner, as at time of new construction the extra cost to install a 100-amp service instead of a 60-amp service was minimal; yet provided the opportunity for additional power in the future, should it be needed.

This code rule is still in effect today.

4 CEC, Part 1, Section 8

6. Aluminum Wiring

If your home was wired between 1966 and 1974 it very likely was wired with aluminum wiring. It was the norm during these years, due to an escalation in the price in copper wire throughout the '60 and early '70s. Aluminum wiring systems can be safe, if properly installed and properly maintained.

The key problem with aluminum wiring is connections and splices becoming loose over time, most commonly due to incorrect devices on the aluminum wire, and lack of maintenance. Once the connections are loose, when an appliance is plugged in and operating, heat is generated at the loose connections. This heat build up can easily escalate to burnt-out connections, melted insulation of the conductors followed by fire.

The key problem with aluminum wiring is connections and splices becoming loose over time, most commonly due to incorrect devices on the aluminum wire, and lack of maintenance.

PowerCheck has found in literally ever house we have examined with aluminum wiring that the connections and outlets and switches have been loose. In many homes burnt connections and melted insulation of the conductors has occurred. So if your home was built during these years, assume it is wired with aluminum unless confirmed otherwise, and have it check for electrical safety.

The key culprit to loose connections has been incorrect outlets and switches on the aluminum wiring. In literally every house we have seen over the years with aluminum wiring the original aluminum-rated, ivory coloured outlets and switches have been swapped for modern standard Decora-style outlets and switches[5]. Aluminum rated devices are available, but are more expensive that standard devices, and may not be so readily available. Aluminum rated devices are identified by "CO/ALR" stamped onto the device. Older devices were stamped "AL-CU". If there is no CO/ALR or AL-CU stamp on the device the device is not designed for use with aluminum wiring.

One solution is "copper pigtailing". However copper pigtailing is often found to be done incorrectly (by using the wrong wire connectors for example). Thus to assure that the copper pigtailing has done correctly it must only be done by licensed electrical contractor, and under electrical permit. In conclusion, if a house with aluminum wiring can be shown to have had copper pigtailing installed correctly, by a licensed contractor under permit, that installation would be expected to be at comparable safety standards to that of a modern installation wired with copper.

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5 Decora style outlets and switches were introduced 1973 offering a contemporary look to electrical devices. Instead of the traditional toggle switch and round shaped outlets Decora style devices were rectangular in shape, looking clean, simple and stylish. They are still as popular today as ever.

7. Old Circuit Breakers

Circuit breakers in your home are the central component of the electrical safety system in your house. It is essential that they are reliable. Their function is to protect the electrical system, by switching off the power to the circuit in the event of overcurrent. Overcurrent results in the wires overheating, which can easily lead to sparks and fire. Overcurrent can occur for example if the circuit is overloaded from too many appliances, or if an appliance is faulty. In both these cases if the circuit breaker is working correctly, once overcurrent is detected it will shut off the power, protecting the home from electrical fire.

All circuit breakers have an expected service life. After that their reliability cannot be confirmed.

The typical lifespan of a standard residential circuit breaker is 30 to 40 years. After that time, to assure their reliability they should be replaced.

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8. Conclusion

The older the home the higher the probability of electrical fire. Statistically speaking, the risk of electrical fire increases with age of home. The risk of a home cannot be determined by the presence of knob and tube, 60 amp service, or aluminum wiring alone. Focusing on these items does little to address risk, yet may burden the homeowner with expensive and unnecessary costs.

The key to bringing old houses to low exposure to electrical loss is to have a careful and comprehensive examination of the electrical system conducted by a Master Electrician experienced in old home electrical systems, followed by having the required corrective actions carried out by a "Licensed Electrical Contractor". Licensed Electrical Contractors are to be found in most towns and cities throughout BC. A list of Licensed Electrical Contractors in BC is available on line from Technical Safety BC, at: https://www.technicalsafetybc.ca/regulatory-resources/find-a-licensed-contractor

For further information on electrical safety and fire prevention of older homes reach out to:

- BC Office of Fire Commissioner: ofc@gov.bc.ca
- Technical Safety BC: www.technicalsafetybc.ca
- BC Injury Research and Prevention Unit, BC Children's Hospital: www.injuryresearch.bc.ca
- PowerCheck Electrical Safety Services: www.powercheck.ca

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About the Author

Brian Cook is the founder of PowerCheck Electrical Safety Services Inc. His expertise is founded on 50 years experience in the electrical field. Brian has a comprehensive background in electrical safety, with specific expertise in the electrical safety of older homes. He is a BC Master Electrician. PowerCheck specializes in conducting electrical risk assessments of older houses for the insurance industry. PowerCheck currently conducts electrical risk assessments in all major centres throughout BC. Because of the his on going work in electrical education, making electrical examinations of older homes easily accessible throughout BC, and developing a standardized protocol for the examination of electrical systems in older homes in 2013 Mr Cook was awarded the Lieutenant Governor Safety Award by the BC Safety Authority (now Technical Safety BC).

For further information on PowerCheck, visit www.powercheck.ca

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