ELECTRICAL:

A. INADEQUATE POWER SERVICE:

Inadequate power service means that the service panel and entrance wiring are too small, in terms of amperage capacity, for the amount of power the house needs. A rough estimate of a house's power need can be computed by adding the major appliance loads, the minor appliance loads, the general lighting loads, and multiplying by 80%. For most houses, 30 amperes for minor appliances and 30 amperes for general lighting, figured at 3 to 4 watts per sq. ft. of floor space, will suffice.

The amperage drawn by the major appliances can generally be approximated. Average sized air conditioners, dryers, and water heaters draw about 20 amperes apiece. Electric ranges draw about 40 amperes and electric forced air heat or heat pumps 60 amps and more. Add about 7 to 10 amperes per electric baseboard heater or window air conditioner. For more precise calculations simply divide the appliance wattage rating by the operating voltage to compute the amperage of the appliance. The wattage is usually stated on the name plate data. This demonstrates that houses without any major electric appliances can often get by on approximately 60 amperes of service, which was the typical installation from the 1920s to about 1950. Those using gas for cooking, heating, and domestic hot water can have an electric dryer and central air conditioning and still get by on 100 amps of service. Those with a full load of major appliances but utilize gas for space and water heating should have 150 amps of service while those homes with all electric appliances should have approximately 200 amps of service.

WARNING: Older houses that have had electrical appliances or room enclosures added without upgrading their service panels often have INADEQUATE POWER SERVICE.

A typical schematic layout for an all electric house with a 200-ampere service shows the entrance cable **(Fig. A1, Item A)**, electric meter **(Fig. A1, Item B)**, main service panel **(Fig. A1, Item C)**, branch circuits for the heat pump compressor **(Fig. A1, Item D)**, supplemental heat coils **(Fig. A1, Item E)**, major appliances **(Fig. A1, Item F)**, kitchen receptacle, **(Fig. A1, Item G)**, and general lighting/receptacles **(Fig. A1, Item H)**.

Another way of figuring the power needs of a house is to add up all the wattage in the house and then use the simplified electrical code computation. This figures that power is needed at 100% for the first 10KW and at 40% for all power after that.

WHAT TO: HOW TO:

A "Heavy Up" is called for when a house has inadequate power service. This means, that the cable from the street into the house, including the meter base and the inside distribution panel, are replaced with thicker ones. In many jurisdictions the electric utility company handles installation and pays for the wiring from the street to the electric meter. In other jurisdictions, the electric utility company may only handle installing the wiring to the house exterior and require the house service cable from the electric meter to their electric service to be provided by the homeowner. In almost all cases, the homeowner is responsible for the wiring from the electric meter onward. A heavy up installation requires coordination with the electric utility company as well as an electrical permit from the local governing jurisdiction.

There is wisdom in spending a little extra money and purchasing a high quality distribution panel. The quality of the connections within the panel is the primary consideration. Beyond that, make sure there will be enough expansion room for any additional circuits needed in the foreseeable future.

REFERENCE: E1, E2, E3, E4, E5, E17

B. ENTRANCE CABLE UNDERSIZED:

The entrance cable, which extends from the weatherhead near the top of the house or via an underground conduit through the meter base and into the distribution panel, should be sized according to the size of the distribution panel. A large panel **(Fig. B1, Item A)** and a small cable **(Fig. B1, Item B)** combination may cause the wire to overheat. This combination usually occurs when a heavy up installation remains incomplete or when an amateur heavy up has been accomplished by a homeowner. Interpret this as a warning that the work was probably not done under an electrical permit. This should also serve as a warning that other amateur work may exist and may constitute a fire hazard.

WHAT TO: HOW TO:

A permit for completion of the heavy up should be obtained, and the new wire and meter base installed. THIS IS A JOB FOR A PROFESSIONAL ELECTRICIAN ONLY.

REFERENCE: E1, E2,E4, E5, E17

C. ALUMINUM GENERAL LIGHTING CIRCUITS:

SPECIAL NOTE: The information below is controversial and has political elements to it. Many fire departments, code enforcement officials, and professional home inspectors take issue with it.

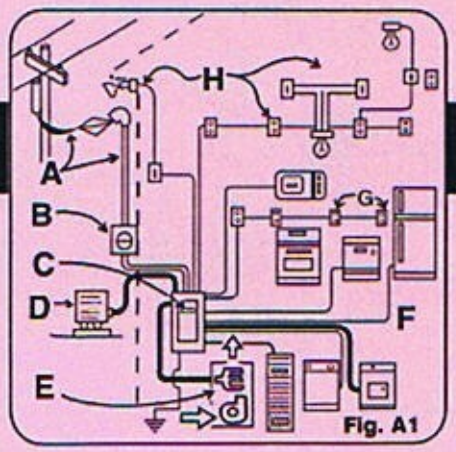


Fig. A1

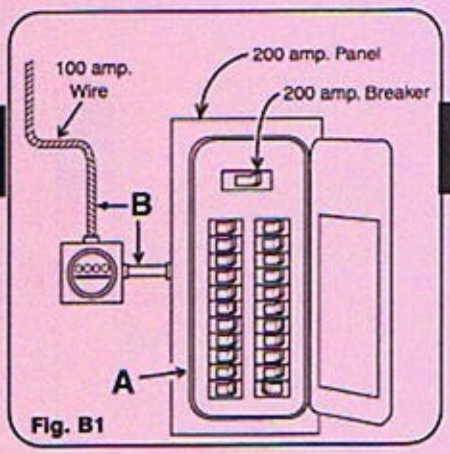


Fig. B1

Major Problems

There are three classifications of wiring circuits within residences: major appliance circuits, minor appliance circuits, and general lighting circuits. General lighting circuits are of critical concern if they utilize aluminum conductors **(Fig. C1, Item A)**. Many tract houses built between 1964 and 1975 utilized this type of wiring and are considered (by the U.S. Consumer Products Safety Commission) a significantly higher fire risk than similar houses wired with copper for these single strand circuits.

Government sponsored research has indicated that aluminum wire heats up and expands more than copper wire. Aluminum wire also appears to have a chemical reaction where it contacts the metal of securing pieces of some receptacles and switches. A combination of these and other factors may cause poor connections and allow aluminum oxide to form on the wires at the connection point. Aluminum oxide is highly resistive to electric current flow. A connection point, that is highly resistive, will heat up as electric current passes through it. This will create an intermittently hot connection situation. According to the government research, it is estimated that one in every five houses with aluminum wire in the general lighting circuits, has one intermittent hot connection.

The National Electric Code is relatively silent on this issue. Over the years, while investigating complaints, the repair procedures recommended by the Consumer Product Safety Commission have changed. At present, there is no specific recommendation for dealing with the larger multi-strand aluminum "service entrance cable" **(Fig. C1, Item B)** and major appliance circuits typically found in most homes **(Fig. C1, Item C)**. NOTE: Some professional electricians specializing in aluminum wire repair feel that there is more of a problem with the multi strand wiring than the single strand wiring.

Popping, snapping, or heat from receptacles, fixtures, or switches is a warning. All connections are to be made in approved electrical junction boxes. Amateur repairs to aluminum wire systems are considered ultra high risk. Insurance rates are generally not affected by the presence of aluminum wire.

CANADIAN DIFFERENCES:
The AMP cop/alum connector method is not generally available throughout Canada. In Canada, an aluminum system is considered safe, provided good workmanship exists. The receptacles should be labeled as either "CU-AL" or "CO ALR". If not so labeled, the receptacles should be pigtailed to the aluminum conductors with "AL CU" marrets (connectors with silver inside). A 3/4 wrap should be made around the receptacle screws.

WARNING: Aluminum wire used with push in type receptacles is considered hazardous. A home inspector will not remove receptacles, and thus will not be able to make this determination.

WHAT TO: HOW TO:
According to the U.S.C.P.S.C. the safest way to repair aluminum general lighting circuits is to have a professional use the AMP Special Industries "COP ALUM" connection method. The work should be done by an electrician that specializes in aluminum wiring repair. Aluminum repair work is NOT COVERED BY THE NATIONAL ELECTRICAL CODE, hence most PROFESSIONAL ELECTRICIANS MAY NOT KNOW THESE PROCEDURES. These repairs involve installing special connecting devices between the original aluminum wires and new short sections of copper wires. The old and new wires are attached by crushing the connecting devices around them with a pneumatic crusher. The now extended wires are then reconnected to the existing receptacles.

This process is relatively expensive ($18.00 and up (depending on competition) per opening and $200.00 and up for the main panel) and must be very carefully done. Older aluminum wires are often somewhat brittle and easily break off inside walls, etc. This method is a less expensive repair than rewiring an entire house, and once this is done, the repaired system is considered safe. Other methods of upgrading safety have been developed, but none approach this high standard. The Consumer Products Safety Commission recommends no other method.

Special "warning" screws were once available that changed color when they heated up. These can be used to attach cover plates over receptacles wired with aluminum. They may give a warning that an intermittent hot connection exists.

REFERENCE: E7, E8

D. UNFUSED/UNPROTECTED CIRCUIT/S > 5':
Wiring that runs to appliances or receptacles is supposed to be protected from overload by a fuse or circuit breaker. Overloaded wires can heat up excessively and become a real fire hazard. Circuits that have no protection are more vulnerable to overheating since they will not trip breakers or blow fuses that alert the homeowner to take action.

Short circuits and fires are more likely to occur with an unprotected circuit. An unprotected circuit run from the main panel to a fused connection must be no longer than 5 feet. Ordinarily, an unfused or unprotected circuit is a strong sign of amateur workmanship, and most likely done without an electrical permit. Occasionally, an amateur will attach additional wires directly to the entrance cable lugs **(Fig. D1, Item A)**. Even with fused protection between the lugs and the receptacle **(Fig. D1,**

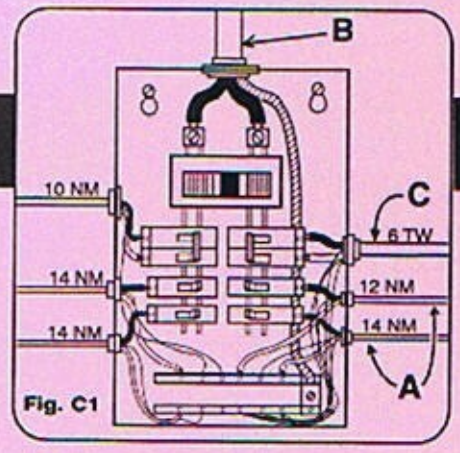


Fig. C1

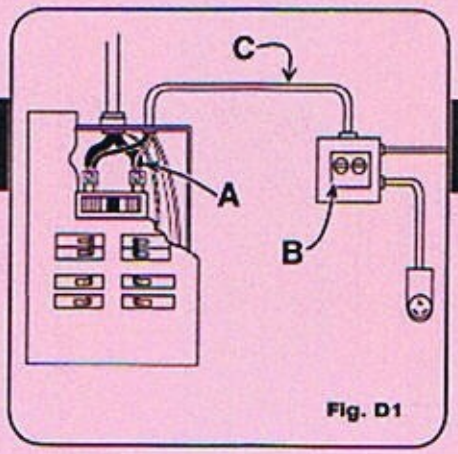
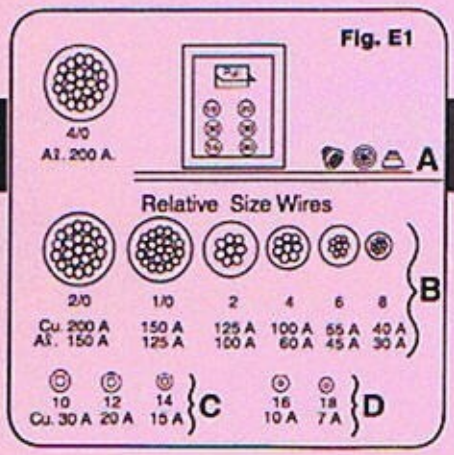


Fig. D1



Item B) there will be a section of wire left unprotected **(Fig. D1, Item C)**, which is potentially hazardous. This type of "work" is usually only done when there is no normal point of attachment within the distribution panel. Frequently, this requires a heavy up service installation.

WHAT TO: HOW TO:
There are often several alternatives when unfused circuits exist. Often the main panel can be supplemented with a sub panel that will provide additional distribution. This usually involves the rearrangement of several of the circuits. If this cannot be done adequately, a new and larger panel should be installed. If the house has inadequate power service as well, the entrance cable and the meter base should be increased in size to match the power need and conform to standards.

REFERENCE: E1, E2

E. OVERFUSING:
Fuses and circuit breakers within panels limit the amount of current that can flow through the wires. Excess current will heat up the wires unduly. When oversized fuses are installed, this overheating can occur. This might occur when someone installs a window air conditioner and plugs it into the general lighting circuit. Frustrated with repeatedly blowing fuses, they put in a higher amperage fuse. Now the fuse won't blow, but the wiring on the circuit will heat up excessively. This often happens in older houses that don't have many individual circuits.

There is a strong temptation to overfuse a kitchen because all of the heat-producing appliances draw a lot of current. The same thing can occur in bathrooms too, since hair dryers and irons also draw a lot of current.

NOTE: A warning sign is a large number of blown fuses lying around a panel box **(Fig. E1, Item A)** and a disproportionate number of 20 or 30 amp fuses in the panel box.

SPECIAL NOTE: Overfusing is generally associated with overfusing a wire, but does not take the load into consideration. Exceptions exist. Electric compressor air conditioners and other motors can be overfused relative to the wire but not to the load. This occurs because motors tend to draw more current when they are starting up. It would be very inconvenient to have a very heavy breaker simply to handle the momentary surge upon startup. For this reason, breakers can be sized to the load and not the wire. The National Electric Code (NEC) allows for a specific percentage overload (usually 40% for motors and 125% for hermetically sealed motors) for selected individual circuits. Naturally, the normal load of the motor or appliance must never overload the wire. A visual home inspection will not generally include checking the load against the wire or safety control device.

WHAT TO: HOW TO:

NEVER OVERFUSE deliberately. Consider changing existing "Edison base fuses" to "S" type fuses to prevent such an occurrence. The different amperage sizes of Type "S" fuses have different pitches to the porcelain threading of their male ends. This is intended to prevent them from being threaded into any fuse base receptacle other than the applicable barbed barrel female inserts, that are used to convert Edison fuse panels to Type S fuse panels.

NOTE: Sometimes Type S fuses can be screwed into inappropriate sockets and may not make a connection. Blowing out the female socket can clear it and allow a proper sized Type S fuse to be installed.

Overloading really indicates that there are insufficient circuits to carry the loads imposed. Commonly, old houses may have the entire second floor on only two circuits. When this is the case, using window air conditioners and hair dryers or curling irons at the same time will almost certainly blow fuses. The appropriate correction is to run an additional circuit to handle each air conditioning unit and an additional circuit to handle each bathroom.

Remember new bathroom circuits should have ground fault circuit interrupt (GFCI) devices according to the National Electric Code (NEC). Be certain the fuse or circuit breaker size is matched appropriately to the wire size.

NOTE: Wires from number 4/0 to number 8 can be used for 240 volt appliance circuits, service entrance, and sub panels **(Fig. E1, Item B)**. Number 10 to number 14 wire are for 120 and 240 volt appliances, general lighting and receptacles **(Fig. E1, Item C)**. Number 16 to number 22 wire are for low voltage lines to thermostats, doorbells, security systems, and telephones **(Fig. E1, Item D)**.

REFERENCE: E1, E2, E4, E5, E6, E17

F. WATER/RUSTED CONNECTIONS IN BOX:
It is common for water and consequently, rust to occur in distribution panels. Often the entrance cable **(Fig. F1, Item A)** leaves the meter base, **(Fig. F1, Item B)** penetrates the wall, **(Fig. F1, Item C)** and drops to a panel in the basement **(Fig. F1, Item D)**. If the caulking around the cable penetration is not kept sealed, rainwater often drips or runs along the cable straight into the top of the box **(Fig. F1, Item E)**. The water may simply drip through the box, or it may corrode connections and internal components.

WHAT TO: HOW TO:
When water has entered the box and rusting is evident, it is wise to shut off the power at the meter, disassemble the box, completely examine it, and clean all the connections. Consider replacing rusted circuit breakers, etc. MAKE CERTAIN THAT WATER CANNOT FOLLOW YOUR ELECTRICAL ENTRANCE CABLE INTO THE PANEL BOX. Rust repair work is A JOB FOR A PROFESSIONAL. Pulling a meter is dangerous. SOMETIMES THE ENTIRE PANEL SHOULD BE REPLACED.

REFERENCE: E4, E5, E17

G. SHORT CIRCUIT BURNED/FRAYED WIRING:
Shorting or short-circuiting means that the electrical current has found an unintended path to ground and draws an uncontrolled amount of current

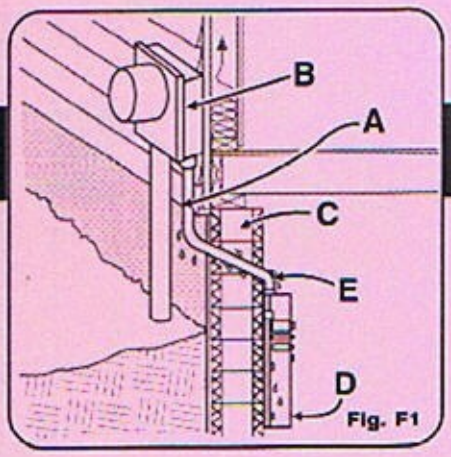


Fig. F1

through the wires. Usually, the circuit protective device will trip or blow and the current will stop. Huge overloads of current flowing through a short circuiting wire will overheat the wire almost instantly. Often it melts the insulation and causes a fire. If a fire does not occur, the likelihood of having another short circuit is very high due to the melted insulation.

If the insulated conductors within a wire package touch, another short circuit will result. Overheating or age can make insulation around a wire brittle. Pieces can break loose **(Fig. G1, Item A)** and expose the wire **(Fig. G1, Item B)**. When receptacles with such wiring are removed and resecured, the wires may drop insulation and then short circuit when they are pressed back into the outlet box. Generally, fuses and circuit breakers will prevent this, but some short circuits can maintain small arcs and produce enough heat to cause fires without blowing fuses or tripping circuit breakers.

NOTE: A blackened fuse indicates that there was a short circuit while a broken filament indicates an overload.

WHAT TO: HOW TO:
Never ignore a short circuit. It is indication that something is wrong. It is dangerous and must be corrected. Find the cause before reactivating the circuit. Amateurs BEWARE: A professional electrician should be called to make repairs.

BURNED/FRAYED WIRING:
Burned circuit ends at fuses or circuit breakers **(Fig. G2, Item A)** indicate a loose connection or that the circuit has overheated. The insulation at the wire's end will melt slightly and may even show signs of charring **(Fig. G2, Detail B)**. A tight circuit that is burned may have already been repaired. OBVIOUSLY THIS IS A WARNING! Check the breaker to make sure the capacity is matched to the correct wire size.

Frayed wiring sometimes occurs when a wire is attached to a machine that vibrates. This frequently occurs on disposals and dryers. Occasionally, a romex wire gets pulled through a tight hole in a stud or a panel and has its insulation stripped, setting up a short circuit.

WHAT TO: HOW TO:

The burned wiring portion should be cut away, and a new clean connection established. Have a professional electrician check the circuit to determine whether an overloading condition exists. Checks of such circuits can be difficult since the leakage to ground may be INTERMITTENT. Frayed wiring should be replaced.

REFERENCE: E1, E2, E4, E5, E17

H. BROKEN GFCI BAD CIRCUIT BREAKER:
Ground fault interrupt (GFCI) devices in houses are essentially "quick trip" circuit breaker devices that are capable of detecting current leakage to ground. They will interrupt the power if more than 5 milliamp leakage is detected. These devices will undoubtedly save lives, but due to their sensitivity, they are prone to failure. GFCI, also called ground fault interrupt protection, is usually provided in several different ways. Either a GFCI circuit breaker will be installed within the main panel **(Fig. H1, Item A)** to protect an entire wiring circuit which is usually run to several different receptacles, or a single GFCI receptacle is installed to protect a number of other receptacles **(Fig. H1, Item B)** on the same circuit. Occasionally, an individual receptacle will contain a GFCI device for that receptacle only. If an outlet appears to be dead and is located in the garage, the bathroom, or outdoor receptacle box, make sure any and all GFCI devices are pushed to the reset position. Occasionally, a device will trip if the bathroom is too misty or even if there has been rainy weather. Ground fault circuitry is not checked.

BAD CIRCUIT BREAKERS can either trip with less than a full load, freeze and not trip at all, or trip and not reset. A buzzing sound from a circuit breaker is common, as well as one that is warm to the touch. A hot circuit breaker usually indicates a bad connection and should be checked out and repaired.

INSPECTION LIMITATION WARNING: These can be intermittent and generally will not be determined during an inspection.

WHAT TO: HOW TO:
A failed device should be replaced. One that instantly trips upon being reset may indicate trouble on the circuit. This latter condition merits a serious check by a professional electrician. GFCI circuit protection devices in bathrooms or located outside houses will often trip due to excess moisture in the air. Make sure exterior receptacles are housed in weather tight junction boxes. The typical weather protected box, which has two hinged covers with gaskets, often fail. Hinges will break, or the gaskets shrink and fall out. Better boxes are angled to shed water and will remain tightly sealed. Landscape lighting with extension cord type wires between lighting fixtures often trip GFCI devices.

Replace any know defective circuit breakers immediately.

REFERENCE: E1, E2, E6, E7

APPLICABLE PRODUCTS: EP1

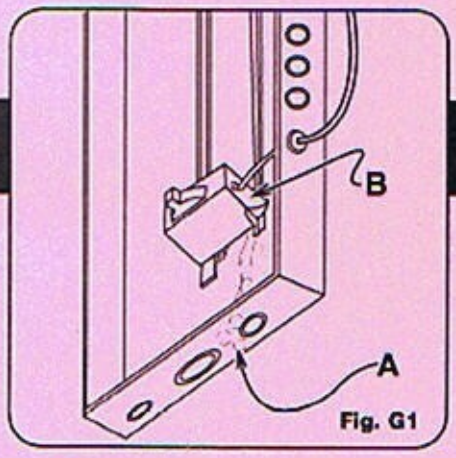


Fig. G1

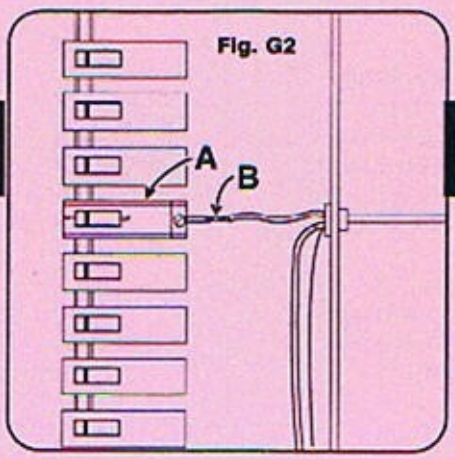


Fig. G2

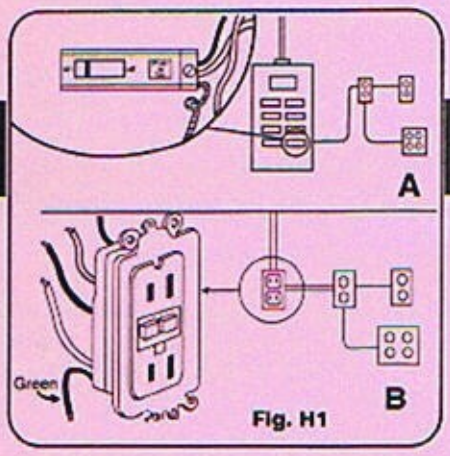


Fig. H1

Major Problems

I. KNOB AND TUBE WIRING SYSTEM:

Knob and tube wiring systems get the name from the porcelain knobs **(Fig. I1, Item A)** and tubes **(Fig. I1, Item B)** that were used to attach wires onto and through the building's framing members. The system used two, individual, insulated conductors to make a very limited number of circuits through a house. Since there were only two conductors, obviously there is no separate ground conductor. Many individual code inspectors consider this type of system the best ever installed because of the clearance between conductors, etc. Some will allow it to remain, while others will insist that any remodeling work be accompanied by a modern electrical system.

Wiring systems that are considered functionally obsolete (fused neutrals, overly extended, inadequate or unprotected connections) or unable to adequately support the electrical usage of a building will generally be deemed a major problem. Old systems, which have been incompletely, upgraded (some knob & tube materials remaining) will generally not be deemed major problems. These systems are invariably old and have frequently been extended to provide increased service.

To extend the service, the insulation on the conductors was scraped away, and a new run of wiring was twisted around the bare spot and taped in position **(Fig. I1, Item C)**. These splices and the extension of the circuitry are very suspect. Today's standards usually dismiss this entire system due to the inadequacy of distribution, the aged insulation on the conductors, the high likelihood of splicing, and the lack of grounding.

WHAT TO: HOW TO:

If you have no intention of upgrading an electrical system or increasing the usage, it is a good idea to have a professional electrician completely check out the system anyway.

Generally speaking, houses with knob and tube electrical service are excellent candidates for complete rewiring.

REFERENCE: E1, E2, E9

J. EXTENDED MAJOR APPLIANCE CIRCUIT:

Major appliance circuits are intended to serve only one appliance. The wire is to be run directly from the appliance to the panel. Sometimes amateurs will feed several major appliances from the same circuit. This often happens when basement apartments are installed.

It is often allowable for an oven and a cooktop to be fed from the same circuit, but in some cases it is not. This is determined by the manufacturer and is specific to the equipment in question.

Often, in older houses, where it is difficult to run new wire from the main panel or there is no expansion room with in the main panel, the extra appliance **(Fig. J1, Item C)** will be electrified by tapping into an existing major appliance circuit **(Fig. J1, Item A)**. The risk is that the added wire will be too small to carry the load allowed by the circuit breaker **(Fig. J1, Item B)** or fuse that was used to protect the original major appliance **(Fig. J1, Item D)**. This "over fusing" of the newly added appliance and its associated wire presents a risk of fire or human contact with electricity, should the insulation fail due to overload.

WHAT TO: HOW TO:

An additional circuit will have to be run from the new major appliance back to the main panel. If there is no expansion room within the panel, a heavy up with greater distribution capability or the addition of a subpanel may be the only remedy.

REFERENCE: E1, E2, E5

K. GROUND BONDING STRAP/ROD MISSING/LOOSE:

The grounding wire (should not be spliced) in the main panel connects the neutral bus bar, the panel enclosure, and all other ground wires.

When remote subpanels are utilized, the ground wire must not be connected to the neutral in the sub panel while the ground wires should all be securely mounted on their own bus bar. The bonding screw on the neutral bus bar of a sub panel should be removed.

The grounding wire that runs from the ground bus within the distribution panel **(Fig. K1, Item A)** must be connected to a proper ground. Traditionally, the ground has been the metal plumbing supply pipe feeding the house from the main line in the street. Plumbers often remove these ground wires from pipes to work on them. Quite often, they forget to replace them when the work is completed **(Fig. K1, Item C)**. Often too, an effective ground is lost when old street plumbing line is rejuvenated with a new plastic one. The new electric code also specifies that it must run to a grounding rod driven approximately 8 feet into the earth **(Fig. K1, Item B)**.

Sometimes work around the exterior of a house cuts the strap or wire to the grounding rod. Occasionally the rod is snapped or loosened in the earth.

WHAT TO: HOW TO:

The grounding of an electrical system must be maintained. If a wire is found loose or missing, it simply must be replaced. The same applies for grounding rods on the exterior of houses. Splicing of ground wires is theoretically not permitted but occurs frequently.

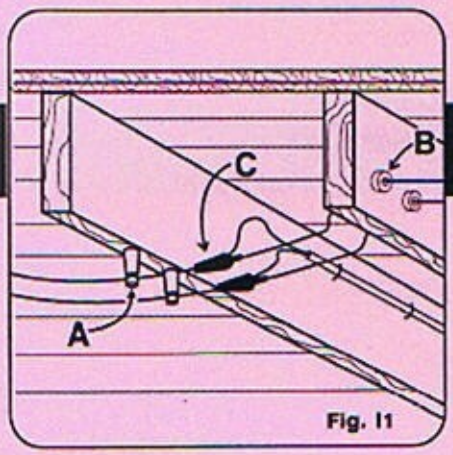


Fig. I1

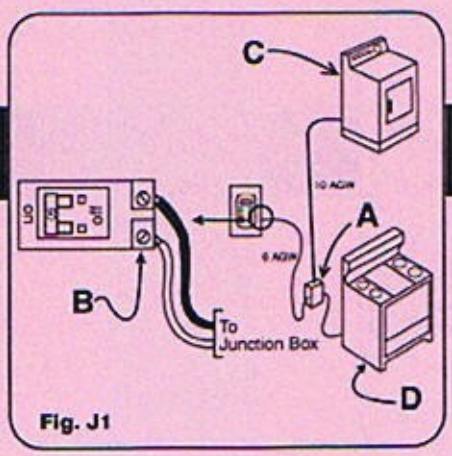


Fig. J1

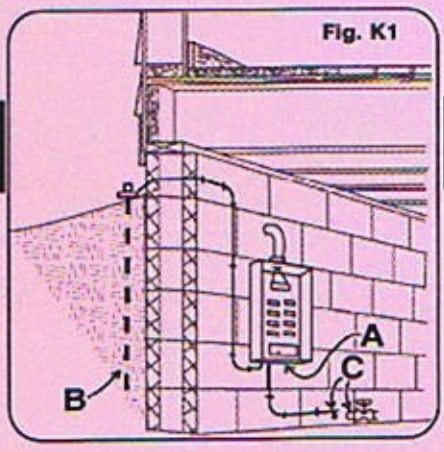


Fig. K1

If the ground wires are not bonded to the neutral bus bar at the main panel, the breakers/fuses will not trip/blow when a short circuit occurs. When the ground and neutrals are not isolated from each other at sub panels, then both wires will carry current back to the main panel. This can cause possible arcing in concealed spaces and the electrical energizing of pipes and other bonded components. This could be a severe shock hazard.

Amateurs beware: Repairs and modifications to ground systems should be made only by professional electricians.

REFERENCE: E1, E2, E4, E5, E9, E17

L. EXTERIOR/INTERIOR CONTACT HAZARD:
Wires strung through the air around homes are supposed to be insulated and at least 12 feet off the ground **(Fig. L1, Item A)**. Power wires entering houses should also be well insulated and kept clear of antennas and the like **(Fig. L1, Item B)**. Wires strung through trees are a real danger, especially when tree pruning.

Driveways next to houses with a meter projecting into the drive area can sometimes be hazardous **(Fig. L1, Item C)**. Open junction boxes with bared wires or uninsulated cables that are readily accessible can be interior contact hazards.

Generally, outside cables should be no less than 18 feet above traffic, 12 feet above a yard or driveway, 10 feet where attached to structures, (clearance is needed above porches and decks) 4 feet away from roofs, and 3 feet away from windows and doors. The Canadian standards are 3 meters above porches, decks, and flat or metal roofs and 1 meter above wooden roofs. Differences in rules may exist in different locations. Always contact the local authorities to determine the rules in your area.

WHAT TO: HOW TO:
Notify the electric utility company of poorly insulated wiring. Avoid placing roof top antennas near electric service entrance lines. Make sure wiring connecting buildings or external fixtures is the right type, and done according to code. Buried wiring is supposed to be at least 12 inches and sometimes 18 inches deep so that it won't be accidentally struck with shallow digging. Replace or raise low slung lines. Shield any interior contact hazards or replace defective wiring.

REFERENCE: E6, E9

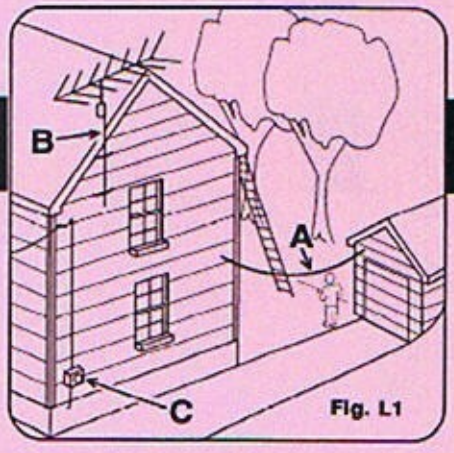


Fig. L1

ELECTRICAL:

a. Entrance/major appliance leads loose/antioxidant needed:
It is very important that electrical connections be secure. Often, common aluminum entrance cable **(Fig. a1, Item A)** and major appliance circuits **(Fig. a1, Item B)** are loose. This is either caused by careless installation or by gradually working themselves loose as they expand and contract under load. Aluminum wiring is supposed to be coated with an antioxidant compound to prevent aluminum oxide (an electrical resistor) build up **(Fig. a1, Item C)** on its surface.

What to: How to:
Any loose wire connection should be tightened. Those that require an antioxidant should generally be disconnected, cleaned, and reconnected with the antioxidant on them. This isn't normally an emergency situation, but should be accomplished by a competent electrician to prevent a problem.

Reference: E4, E17

Applicable Products: EP2

b. Tripped breaker/s Blown fuse(s):
Tripped breakers and blown fuses may indicate nothing more than a power surge. However, they may indicate overloading or intermittent short-circuiting. Note: Fuses will usually blacken when there has been a short circuit.

What to: How to:
Before resetting circuit breakers or reinstalling fuses, make certain that there is nothing obviously wrong with the circuit. A blackened fuse indicates a short circuit, which is a problem. The fuse should not be replaced however, until an electrician has made appropriate repairs. Breakers often trip with overloads and occasionally during storms, etc. If a breaker continues to trip for no obvious reason, have a professional electrician check it.

NOTE: Ground faulted breakers tend to be very sensitive and trip more often than other breakers.

Reference: E5

c. Multiple taps/Circuits? Extending of circuitry?
Often within a panel, there will be two leads attached to a single circuit breaker or fuse **(Fig. c1)**. This may simply be a convenient spot to attach two legs of a single circuit, or it may be an indication that a new circuit was added but there was no space to attach it. In the latter case, the one protective device would serve for two different circuits. A visual home inspection will not generally be able to conclusively identify any circuit difficulties. It is recommended that competent electricians perform a circuit check.

What to: How to:
One lead can be removed from the protective device to determine what no longer works. The other lead can then be removed to find out what else is on the circuit. If the total loads constitute an overload, the circuit should be divided. The desired result is to have one of the leads powered and protected by an additional breaker or fuse that has been installed in the panel.

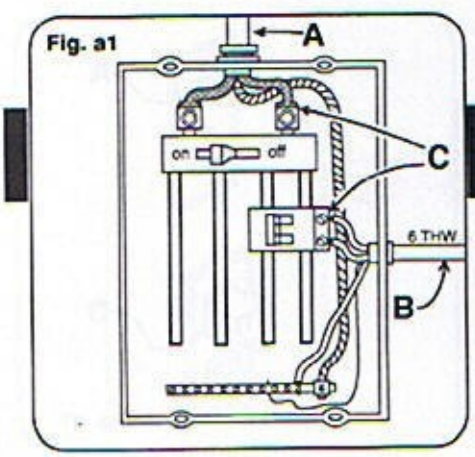
"Piggy back" circuit breakers have been available for many panels in the past, but may no longer be available or allowed in some jurisdictions. They are really two circuit breakers packaged in the size and shape of one. If dubious, hire a professional electrician.

Reference: E10

d. Circuit(s) not connected in panel:
Sometimes old circuits are disconnected within a panel and the old protective devices are used for new circuits. For example, window air conditioning circuits are usually no longer used once central air conditioning is added to a house. Furthermore, someone can pre-wire something in the anticipation of future remodeling or additions. Most of the time a discontinued wire within a panel box will be coiled and tucked away **(Fig. d1, Item A)**. Sometimes the old wire will be disconnected and left hanging loose **(Fig. d1, Item B)**.

What to: How to:
There is often no need for action provided that everything in the house is working properly. It might prove wise to run a circuit test to determine exactly what is on each circuit. For example, it a short was found in a wire run, the home lead may be abandoned, with power being supplied by a new home lead for the circuit. Call a professional electrician if you suspect this.

Reference: E10



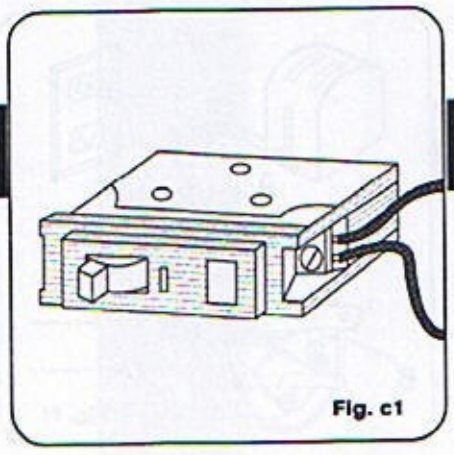
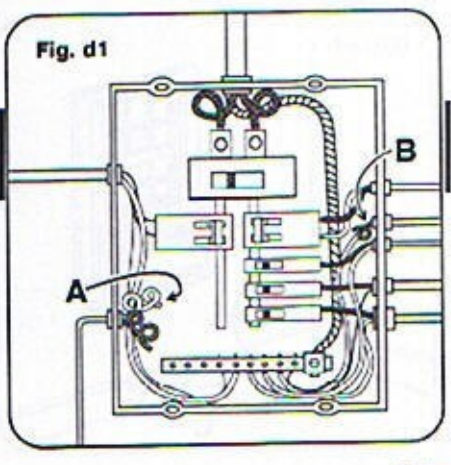


Fig. c1



e. Extension cords Spliced wires:
Extension cords within houses are to be avoided and are especially hazardous if they extend through walls, **(Fig. e1, Item A)** floors, or under rugs **(Fig. e1, Item B)**. It is common for people to insert a thin extension cord into a receptacle and plug a large appliance into the extension cord. Under these conditions, the thin wire will quickly heat up and may burn **(Fig. e1, Item C)**. A thin cord can heat up, burn and never trip a circuit breaker or blow a fuse. Using such cords can negate the protective value of these devices.

WARNING: Extension cords that run under carpet are considered very dangerous.

PROPER CONNECTIONS ARE CRITICAL IN ELECTRIC SYSTEMS: There are approved ways of joining wires. Ideally, connections will be accomplished using approved "wire nuts" or they will be soldered together and insulated with tape. All splicing or joining of wire should be done within approved junction boxes. Splicing wires may be done carefully and is quite safe however, wires are often loosely wound around each other and insulated with wrappings of tape. Such loose connections may easily heat up and cause a fire. Poorly spliced wire connections are to be avoided and are not to be depended upon.

What to: How to:
If you must use an extension cord, make sure it is at least as thick in wire gage as the appliance cord it serves. Never run extension cords through walls, floors or under carpeting.

Wire connections should be made in junction boxes. If you wish to correct an "open air" spliced connection, terminate one end of the wire in a junction box leaving about 6 to 8 inches of extra wire through the box. Secure another junction box several inches away on the other wire leaving the same amount of excess wire through that box. Now join the two wires with a third length of wire between the two junction boxes. Normally the junction boxes will be about 12 to 18 inches apart.

Reference: E4, E5, E17, EX42

f. Frayed appliance wires plugs:
Frayed appliance wires are dangerous. The frayed section makes it relatively easy to short the internal conductors against each other, or even to short one of them against an appliance body, a pipe, etc. Either replace the wire or discard the appliance. Make certain any wire you replace is at least equal in wire gauge size to the one you are replacing.

The old style plugs on the ends of wires should have covers that protect the screw attachments around the prongs. If the cardboard is missing, a short circuit across the prongs may occur when the plug is pushed into a receptacle. This is what typically accounts for those black "burn" marks occasionally seen on the cover plates of receptacles.

WARNING: It is common for short circuits to occur because of frayed wires **(Fig. f1, Item A)** and plugs that lack covers at their prongs **(Fig. f1, Item B)**.

What to: How to:
Replace the wire, the plug, or both, but do not indiscriminately use anything that is suspected or known to be dangerous. Appliance cords and plugs are inexpensive and can be installed in minutes. If you have any doubt about an appliance, have an electrician or appliance repairman check it.

Reference: E6, E9, EX42

g. Nonpolarized/ungrounded adapter/s:
There is increasing concern about the polarization to appliances in a home. Computers, microwaves, and some color TV's demand it. Many ungrounded (2-slot) receptacles have one slot larger than the other **(Fig. g1, Item A)**. This is intended to provide power to the shorter slot and a neutral return to the longer slot. However, many plugs and plug adapters have equally sized prongs **(Fig. g1, Item B)**. When plug adapters are used, often the ground is broken or not connected properly **(Fig. g1, Item C)**. Naturally, keeping the poles correct requires everything in the series to be lined up properly. This is why newer receptacles have different size slots, and new plugs have different size prongs. Adapters should have different size prongs as well.

What to: How to:
Upgrade your plug adapter to the polarized type and do not break off the grounding attachment or wire. This requires that the round probe or the wire be attached to the adapter. When you use an adapter, connect the ground **(Fig. g1, Item D)** wire to the metal screw in the center of the cover plate.

Reference: E1, E2, E5

h. WIRES/BOXES uncovered/loose unprotected fixtures broken/defective clearance?:
Loose wires **(Fig. h1, Item A)** and junction boxes **(Fig. h1, Item B)** should be secured to prevent the loosening of connections or fraying wires. Open or uncovered junction boxes **(Fig. h1, Item C)** should be covered to prevent the possibility of accidental contact. Some jurisdictions prohibit surface mounted Romex type wire.

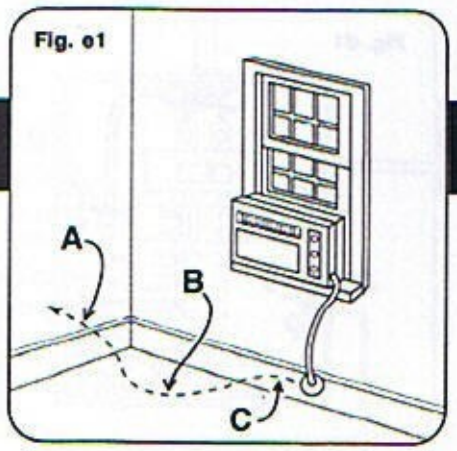


Fig. e1

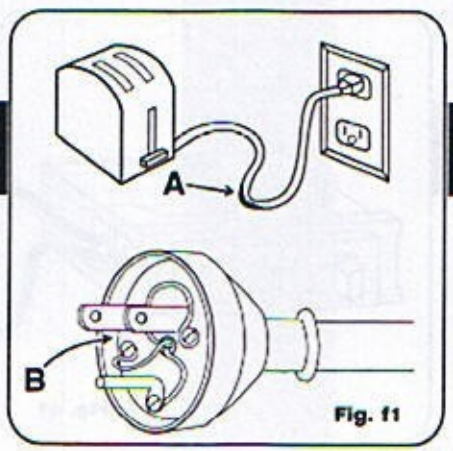


Fig. f1

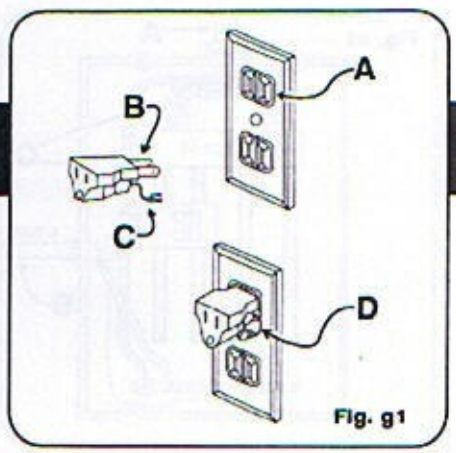


Fig. g1

Lighting fixtures often break or crack. Pull chain type lights often fail.

Some closets contain incandescent lights, which may be close enough to clothing to start a fire. Generally speaking fluorescent lighting that is well protected, is advisable for closets. Some lighting fixtures may be found fitted with bulbs of a higher wattage than they are rated for. This condition introduces the potential for overheating and fires. NOTE: This type of check is not part of the visual non-intrusive home inspection. Check with electricians, code officials, etc.

What to: How to:
Staples and junction box covers are inexpensive. If the wires or boxes are to be attached to foundation walls, attach a piece of board to the wall first and then attach the wire or box to the board. NOTE: Metal junction boxes attached directly to foundation walls are sometimes found rusted and destroyed due to dampness. Mate junction box covers to open junction boxes and screw them tight. Replace broken or defective fixtures.

Reference: E1, E2, E10

i. Receptacles dead/ungrounded Painted/broken/ covers/rusted/loose poor connections Reversed polarity:
There are a host of minor deficiencies that are common with receptacles and should be corrected.

Dead outlets mean no power is getting to the receptacle and may mean that a wire is loose or disconnected. CHECK ANY DEAD RECEPTACLE. The potential for a short circuit exists and this should be repaired. Some beginning analysis can be done by using of a receptacle tester **(Fig. i1, Item A)**.

An ungrounded receptacle usually needs the ground wire connected. In some cases the ground wire will not be present as a part of the original house wiring and will need to be added. NOTE: Three hole receptacles that have been installed as an upgrade from the two-hole type may not always be easily grounded.

Painted receptacles may make plug insertion difficult and can reduce the likelihood of making good contact in the receptacle. A home inspector will not generally attempt to plug testers into heavily painted receptacles.

Broken receptacles can cause short circuits and should be replaced **(Fig. i1, Item B)**. Loose receptacles can fray wires and may short circuit to nearby components.

Receptacles without covers are electrical contact hazards, particularly for children **(Fig. i1, Item C)**.

Poor connections call for receptacle replacements. Receptacles that rust can lose connections and even arc and cause a fire. RECEPTACLES LOCATED INSIDE BLOCK FOUNDATION WALLS OFTEN BECOME DAMP AND RUST.

What to: How to:
The replacement of dead, ungrounded, loose receptacles requires professional repairs. Competent homeowners can usually repair other minor deficiencies. RUSTED receptacles in basement block walls should be removed and the cavity in the block wall foamed, to prevent further water or dampness infiltration. A new receptacle box and receptacle should then be installed. NOTE: MOST FREQUENTLY THE DAMPNESS IN THE WALL IS DUE TO POOR DRAINAGE ON THE WALL OUTSIDE OF THE WALL. The source of the dampness should always be addressed.

Reversed polarity:
A reversed pole situation causes the current to energize the wrong parts of tools and some appliances. Reversed polarity in receptacles can result in the energizing of the frame of appliances and tools, which have faulty internal insulation. NOTE: Under the worst conditions, this can cause an electrocution.

Some microwave ovens, television sets, and home computers can be damaged by plugging them into receptacles with reversed polarity.

Reversing the poles of receptacles most often occurs when homeowners "upgrade" their older two hole outlet receptacles to the newer three hole type, or when they "fix" broken receptacles. This will also occur when an amateur does the wiring. A reversed polarity condition is readily detected by using a plug-in receptacle tester. A neon light type probe screwdriver can also detect whether the correct slot is live. NOTE: On a three hole receptacle, the shorter of the two slots should be live.

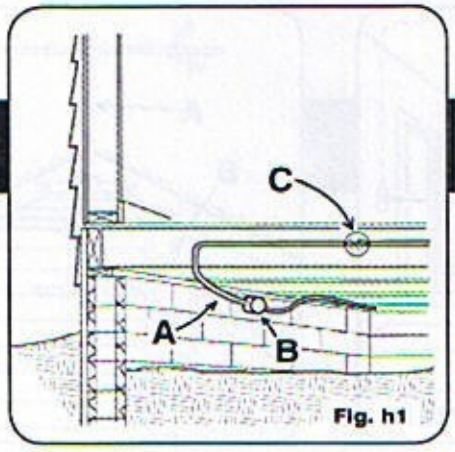


Fig. h1

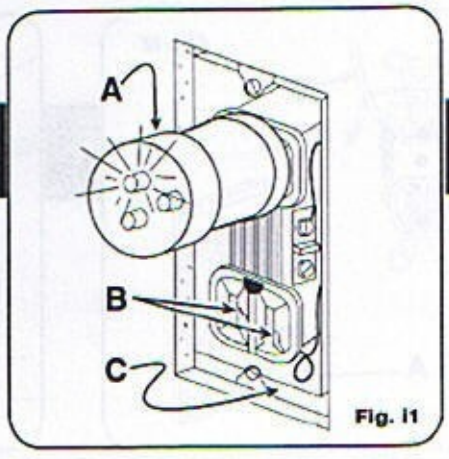


Fig. i1

What to: How to:
Correcting reversed polarity at receptacles involves attaching the wiring leads to the correct screw connections of the receptacles. As a general rule, the black insulated lead attaches to the brass colored screw **(Fig. i2, Item B)** while the white insulated lead attaches to the white metal screw **(Fig. i2, Item C)**.

WARNING: When there are reversed polarity receptacles, it is important to work from the beginning of the circuit, since changing the poles on one receptacle can affect everything downstream on the same circuit. NOTE: The "hot" wire should always be attached to the shorter slot side of the receptacle.

Reference: E1, E2, E5, E9, EX42

Applicable Products: EP1

j. Switches/dimmers defective multiple pole needed:
Switches and dimmers are usually of the two pole type, in order to control a light or appliance from one location. These often fail. Failed switches and dimmers should be replaced immediately to avoid potential arcing, and consequently, overheating. Sometimes a switch is replaced with a dimmer. If the replaced switch was a 3 pole type, **(Fig. j1, Item A)** which is used when control of a light is desired from two different locations, then the dimmer should also be a 3 pole type **(Fig. j1, Item B)**. If, instead of 3 pole dimmer, a 2 pole dimmer is used, neither switch location will completely control the light. Often the dimmer will only work when the other switch is in one position only.

What to: How to:
Replace all switches with ones that have the same number of poles. Hook up wires to the same poles the original switch used. Make certain that the switch is adequate for the load running through it. Most lighting circuits in homes are rated at 15 amps. Heavier circuits utilize thicker wires, which is a clue that heavier devices are needed. Most devices are marked with their rated amperage.

Reference: E4, E5, E9, E17

k. Antenna close wire contact/Ungrounded:
Every year people are killed in the process of installing or removing TV antennas. This frequently happens when the antenna, usually made of aluminum and therefore a great conductor of electricity, is dropped or bumped against incoming overhead power wires. NOTE: Just because there is insulation on a wire does not mean electricity will not flow through an object touching that wire.

Keep antennas at least a distance equal to their height away from incoming power wires. Another residential electrocution situation occurs when aluminum ladders **(Fig. k1, Item B)** contact overhead wires. Mounting an antenna on the same side of the house as the electric entrance cable **(Fig. k1, Item A)** increases the chances that such an electrocution may occur.

There is supposed to be a ground wire from an antenna to a rod driven into the ground.

What to: How to:
Observe your antenna in relation to the incoming wires. If it is close to power wires and they are poorly insulated, make sure you vociferously warn any workmen. Make sure that the antenna is securely mounted and will have no chance of blowing against the wires in a heavy wind.

Warn anyone working near an antenna which has close contact to electric wires. Have an electrician install a ground to any antenna found ungrounded.

Reference: E5, EX42

l. Entrance frayed/in trees:
When entrance cables are frayed, they are more of a contact hazard. Those that run through trees can be dangerous, especially to people pruning trees, etc. The combination of frayed wiring and trees can set up contact hazards when the tree is wet.

What to: How to:
Contact the electric utility company and inform them of the situation in writing. Request an upgrade of wiring. Always inform anyone working in a tree through which power lines pass. It is easy to mistake a dark wire for a branch. People have been killed when cutting through such "branches".

References: E5

m. Meter/entrance cable loose/frayed/drip leg:
It is common for entrance cables and meter boxes to become loosely mounted to houses. It is very common, during remodeling work, for these cables to be disconnected and then poorly reconnected. This often happens when new siding or roofing is installed.

Frayed cable outer jackets can allow deterioration of the insulation and conductors within them.

The drip loops on entrance cables are located where the house wire and the street wires are joined at the weather head. These connections should

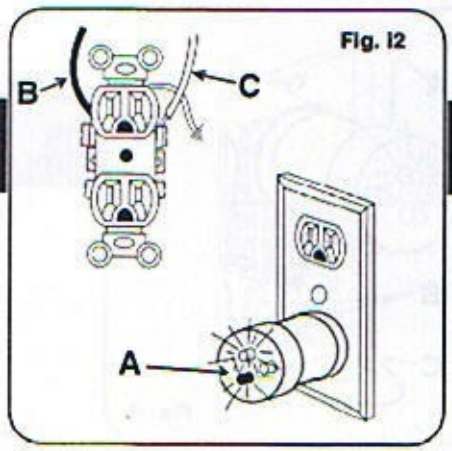


Fig. i2

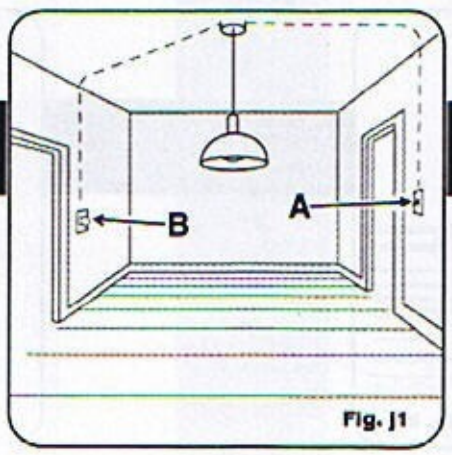


Fig. j1

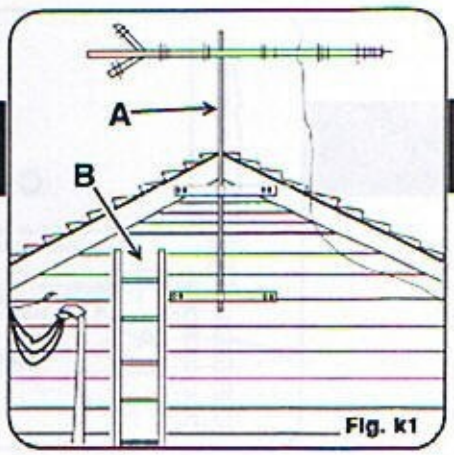


Fig. k1

not be on the bottom of the loops where water has a better chance of getting to the wires.

What to: How to:
Simple clamp devices will secure most entrance cable wires. Electric utility meter bases should be secured by screws, which run through the back of the box. WARNING: This should be done only by a licensed electrician since there is a strong possibility of electrocution when the meter is pulled for access to the screws.

Frayed wiring can often be repaired with tape or painted to prevent the sunlight from deteriorating the insulation of the interior conductors. Badly frayed wiring should be replaced.

Notify the electric utility company of drip legs that collect water.

Reference: E1, E2, E5, E9

n. Outside fixtures open to weather:
Weather can oxidize or corrode connections in outdoor fixtures. Receptacles set into exterior house and retaining walls are commonly missing covers **(Fig. n1, Item A)**, and most covered boxes soon lose their water tightness. Receptacles within retaining walls often get wet and have their wires stretched as the wall tilts. Exterior accent light poles are often broken at the base from rust **(Fig. n1, Item B)** or have cracked globes which let in water **(Fig. n1, Item C)**. Consider these receptacles excellent candidates for ground fault interrupt protection. If these circuits are ground fault protected, the device will trip when it detects leakage to ground.

What to: How to:
Be very cautious around any outside receptacles and fixtures. It is easy to become the electrical currents' path to ground, and it is very easy to encounter receptacles and fixtures that have leakage to ground. For better safety, have an electrician ground fault protect all outdoor wiring.

Reference: E3, E4

o. Inappropriate wire Panel damage:
Different environments require different types of electrical cables. Wires exposed to direct sunlight must be UV (ultra violet) light resistant, **(Fig. o1, Item A)** while those passing through damp spaces must be more water resistant **(Fig. o1, Item B)**. Those which run underground must be able to resist water as well as the acidity or alkalinity of the soil **(Fig. o1, Item C)**, etc. The typical markings, found on non-metallic cable would be UV resistant, NMC, and UF. Some jurisdictions do not allow the use of romex type wiring to be stapled or secured on a surface where it could be easily damaged, such as in a garage or mounted on open studs in a workshop. Plastic jacketed wiring is often simply stapled in garages and other locations. This may be deemed inappropriate by the local authorities.

Damaged panels, including missing covers or open holes in covers or boxes, can be dangerous. Broken inner components may cause short circuits or hot connections. Parts or panel boxes should be replaced. Covers should have no access to live conductors without removing it. Knockouts can be temporarily sealed with tape. Special snap-in devices are available for permanent repairs.

What to: How to:
Consult a professional master electrician or the local building authorities for the correct wire type to use in different environments. Make appropriate changes.

Reference: E12, EX42

p. Doorbell nonfunctional:
Most doorbells are powered by low voltage current and so use thin wires. Many fail due to wire breakage or transformer failure.

What to: How to:
Transformers for doorbells often fail, as well as exterior push buttons. These two areas are almost always the cause when a doorbell doesn't work. Simple replacement is usually recommended since these components are inexpensive. Many new phone systems can incorporate your doorbell into the system. This provides an obvious measure of convenience but also can provide an extra measure of security.

Reference: E5, E9, EX42

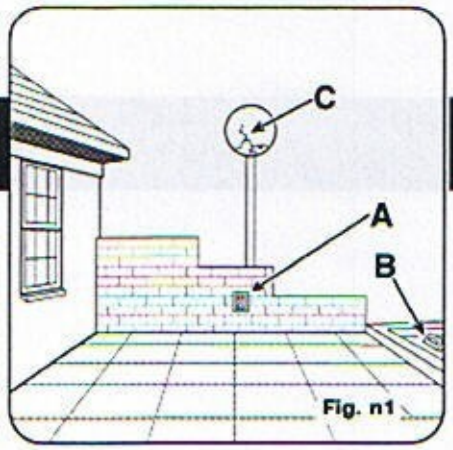


Fig. n1

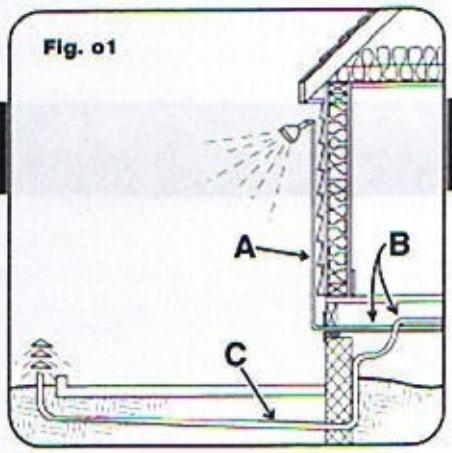


Fig. o1

q. Sub Panel bonding/grounding ?

Over the years the grounding methodology and procedures of electrical systems has been continually upgraded. Additionally the definition of what is truly considered a sub panel has varied a lot in different locations and even by code officials and practicing electricians.

In days gone by distribution panels that were connected but remote from house main distribution panels were often wired with 3 individual conductors. Of late, the practice is to use 4 conductors so that the neutral bus in the sub panel can be isolated and the grounding bus can be connected to the grounding bus in the main panel by its own separate conductor. This latter procedure improves the system grounding for a number of technical reasons.

Inspectors who find "sub panels" which are not wired with an isolated neutral may point this out and suggest that you contact a professional electrician for better technical guidance. Bear in mind that many older sub panels were not wired with 4 individual conductors. It is generally beyond the capabilities of generalist home inspectors to discern the level of hazard such a situation may constitute.

What To: How To:

A professional electrician or a code authority should check items of this type. Where necessary repair are required, a professional electrician should make the repairs.

References: E1, E2, E5, E12, E14

ELECTRICAL:

NOTE: Some electrical distribution boxes have a section of the box, which has a seal. This is to ensure that this portion has not been opened by anyone but the power company. This is common in Canada. Such portions of boxes will not be opened during a visual home inspection. This will limit the amount of disclosure available on that equipment.

EMF or Electromagnetic fields from power lines, appliances, machinery, etc. have been popularly thought to have potentially negative health effects by having a cell altering effect on living tissue, as well as altering chemical and electrical functions within the body. The research is ongoing on this subject and there is some remaining controversy, but by and large the "experts" feel there is no proven danger. If you have such a concern you are advised to seek out an expert. The visual home inspection, in no way, checks or represents anything about electromagnetic fields.

ELECTRICAL MAINTENANCE:
Maintaining an electrical system is primarily a matter of routine inspection and keeping connections clean and tight. It is also a matter of having necessary repairs made promptly and professionally. Likewise a system should only be used within its design capability. Expanding an existing system or adding to it to meet present standards of convenience and safety is somewhat beyond maintenance. However, it happens all the time, so guidelines will be given.

Every 6 months or so inspect your system.

At the main panel, check the circuit breakers when they are not passing current. Flip them off and back on again. Sometimes they won't reset. Replace those that do not.

Outside the house: Check power wires leading to the house for insulation. If the insulation is loose or frayed, call the power company and request repairs. Check the security of the weatherhead attachment to the house as well as the wire that travels down to and through the meter base. Make sure the caulking around the wire/wall penetration seals well. Check any outdoor wiring for fraying or rusting fixtures. Make sure the covers over outdoor receptacles fit weather tight.

Inside the house: check all receptacles to see that they are tight in the wall (basement receptacles that show rusting should be replaced, junction box and all) and that there is a tight plug connection. (Never paint over receptacles.) Check appliance plugs to be sure the wires are not frayed and that there is a cover surrounding the prongs.

NOTE: Never pull a plug out of a receptacle by the wire.

Check switches to be sure they operate properly. Sometimes a bad switch will double click or will only work if the switch pole is pushed. Replace any broken switch or one that arcs or sparks. Consider replacing rheostats with dimmer switches for energy savings and to avoid the heat build up of the rheostats. Make sure your light fixtures use the proper wattage bulbs. NOTE: Over bulbing (using too high a wattage bulb for the fixture) can cause fires. Look for melted shades. When you remove bulbs check the socket for scorching or heat discoloration. Never install higher wattage bulbs than specified for the fixture. Consider spraying WD40 or similar lubricant on the threads of bulbs prior to installing them. This makes it much easier to take them out later.

Avoid using extension cords and absolutely never use an extension cord of less capacity than the appliance it serves. Never run extension cords through walls or floors and never run them under carpets. Do not secure extension cords with nails or staples. Replace frayed appliance cords and cords that get quite hot with thicker ones.

Examine light fixtures for hanging wires. Cover any open junction boxes and terminate any loose wires in closed junction boxes. Secure loose wires to wall furring pieces or floor joists.

The standard residential voltage is approximately 120/240. This is a generalization and is not intended to be an exact measurement of the voltage entering a property. Generally speaking, residential properties utilize "single phase" electrical power. NOTE: More properly this should be called two phase but the popular vernacular is single phase. Many commercial properties utilize three phase power and some residential properties in commercial areas will also have this available. Three phase power is generally used where heavy motors and the like are anticipated.

A. **TYPICAL ACCESS** to electrical systems allows easy removal of the distribution panel cover and easy visualizing of the normal wiring runs. NOTE: Wire connections within junction boxes or within restrictive access spaces are not generally inspected via visual home inspections. A random sampling of outlets are checked for continuity, polarity, and ground. Fixtures are not removed or checked. When bulbs do not light up, it is presumed they are burned out. Bring a bulb and check the operation of the lighting fixture on the pre-settlement walk-through inspection.

B. **RESTRICTED ACCESS** means that less than normal access was available, hence less was examined and available to be reported upon.

C. When the electric **POWER** is **NOT ON**, the system cannot be checked as it normally would be. The distribution panel is opened and reported upon, but the outlets, switches, etc. cannot be inspected. The visual portions of the wiring system will be inspected.

D. The **ENTRANCE CABLE** refers to the cable extending from the weatherhead through the meter and into the distribution box. Sometimes these are not the same size and different texts will rate the differing conductor diameters differently, therefore the ratings listed here will be approximate.

The meter base rating should be coordinated to the entrance cables and the distribution panels. Meter bases are frequently not marked and any rating entered by a home inspector is his/her best approximation.

INSPECTION LIMITATION WARNING: Underground cables cannot be seen and therefore will be approximated from what material is seen within the distribution panel.

E. The **MAIN BOX** or distribution panel/s within houses are sometimes labeled with amperage ratings and sometimes not. Those given here will be approximations.

F. An **EXPANDED SYSTEM** refers to electrical system "growth" after the original system was installed. It means extra panels or wiring has been installed. The older expansion methods will generally not conform to the updated building code systems used today. The work may or may not have been done with an electrical permit. WARNING: You can expect more problems and deficiencies with such a system.

G. **UNDERGROUND** entrances should always be checked for water. It is common for multiple meters that are mounted on boxes and remote from the building, to admit water to the inside distribution panel via the connecting conduit. Look for rust on the panel. Rusting and water signs are always signs of potential trouble.

H. Check the **WEATHERHEAD** for firm attachment to the house and see that the drip loops are connected at points other than the bottom of the loops. If the wire at the weatherhead is bare, ask the power company to insulate it. Bare wire would generally be considered a contact hazard.

I. Check circuit **BREAKERS** every 6 months. (Do not turn the circuit breaker protecting a running air conditioner or heatpump off and then back on as it may trip an over pressure switch on the equipment. This will require a service call to correct.) A circuit breaker that clicks to the off position, but does not terminate the power, needs immediate replacement. Circuit breakers that "freeze" or won't trip need to be replaced as well. Sometimes a tripped circuit breaker will not restore power when it is turned back on. Replace such a breaker immediately. Circuit breakers that buzz when power goes through them should be checked for a tight connection. NOTE: Buzzing circuit breakers often indicate that the breaker is carrying current that is near its capacity.

Circuit breakers that cause vibration of the panel should be checked and replaced if necessary. Rusted circuit breakers should be cleaned or replaced. Loose circuit breakers or those that have to be held in with the access cover plate, generally indicate a low quality distribution panel.

Use spacers or tape to cover any access holes large enough to permit a finger to reach beyond access covers. WARNING: Leave circuit breakers for electric compressor air conditioners, refrigerators, or heatpumps off for at least 2 minutes prior to resetting.

INSPECTION LIMITATION WARNING: Circuit breakers are not generally tested during a visual home inspection. Do this at the pre-settlement walk-through inspection or immediately upon occupancy.

J. Check **FUSES** every 6 months. A blackened fuse indicates a short circuit. The reason for the short circuit must be determined before power is restored on the circuit. Unless the cause is found, a fire hazard exists.

Ordinary or Edison fuses can be changed to "type S" fuses for safety considerations. A barbed barrel is turned into the original fuse female fitting. This prevents (theoretically) overfusing by sizing its inner diameter to receive only the appropriate fuse. NOTE: This does not work perfectly and occasionally a larger fuse will be forced to fit. As a result, the porcelain threading of the fuse is often deposited in the female fitting. Blowing these out later may correct a bad connection.

The screws beneath fuses may loosen with time. When this happens they can arc and heat the wire. This is often detectable by moving the circuit wire that is attached to the metal piece that reaches back to this screw. If it moves with the wire, the screw is loose and should be tightened. If damaged, the piece should be replaced.

Buzz/hot indicates that either a fuse or circuit breaker was making a buzzing sound or was hot to the touch. This infrequently occurs and is not necessarily a problem. When fuses or circuit breakers are fully loaded they tend to heat up. Have a professional electrician check it if you wish to know more.

K. **RESETTABLE** fuses refer to those devices, which have buttons on them that reset like circuit breakers. These are substitutes for turning type fuses. Mini circuit breakers are available that fit in fuse holder female fittings. They have a button on the end, which allows them to be instantly reset.

Useful upgrade suggests upgrading regular fuses to Type S fuses or upgrading the entire distribution panel.

L. A **LABELED** panel is one that contains a legend on it or nearby that indicates which circuit serves which part of the house. A visual home inspection makes no check as to the accuracy of the labeling. See "How to do a circuit check of your electrical system" on the reverse side of the electrical NCR inspection form.

M. An **UNLABELED** panel provides no mapping to the existing circuitry and might indicate amateur workmanship.

N. **SINGLE** refers to the number of distribution panels within the house.

O. **MULTIPLE** panels refer to distribution boxes (not disconnects or fused shutoffs) and they may be fed via other panels or troughs.

P. A **TROUGH** is usually a rectangular box that takes a main power feed and connects it to multiple feeds that are routed to separate distribution panels. They usually have "bugs" that connect the wires which should be checked for tightness every two years or so. This is a job for a professional electrician. It involves unwrapping the tape and re-wrapping when the check or tightening is done. The heavy current passing through the wiring here heats and cools the wiring and connections, and loosening is common. Check this yearly. If the bugs are hot with a heavy load through them, they generally need tightening.

Q. **EXPANSION** room for an electrical system refers to the immediately available contact points within a panel box. Many boxes will have adequate power available for expansion but no contacts. These usually

require the installation of a sub panel. Always check with the local code authorities on what is permissible. Their decisions vary enormously.

R. NO EXPANSION room means that all of the capacity of distribution paneling systems or the available power is utilized and no extra circuitry can or should be installed. This means that a "Heavy Up" of the service, or additional distribution panels will most likely be required if extra circuitry is desired. Anticipate extra risk or expense.

S. Air Conditioning easily accommodated refers to the amount of total power available within the system to supply power for this heavy appliance, should it be installed. There may not be any contact points available within the existing distribution panel, but if there is adequate power, this will suffice for this category.

T. If air conditioning is **not easily accommodated** this means the service or distribution will not accommodate such a heavy appliance. Generally a heavy up or added distribution paneling is required. This does not mean necessarily that extra lighting circuitry could not be accommodated.

U. LOOSE WIRING within the panel refers to circuits that do not connect to fuses or circuit breakers. They may exist for planned expansion or for circuits no longer used. A visual home inspection will not generally be able to determine exactly what the function of such circuitry is.

Ua. HOSTILE ENVIRONMENT means that electrical distribution boxes and the like exist in corrosive or other such environments that can lead to problems. It is recommended that they be relocated or repeatedly checked to determine whether any deterioration is actually occurring.

INSURANCE INFORMATION: Insurance companies interpret different things that presumably lead one to an understanding as to whether or how to underwrite and insure a building. Often the questions asked do not directly interpret appropriate safety considerations. The information given here tends to conform to typical questions asked. These are strictly approximations.

V. The **ORIGINAL** service means that the distribution panel has not been increased in capacity.

W. A HEAVIED UP service means a new cable and panel have been installed. Heavied up service panels are not always set in the same location. They often tie new circuit protective devices to old circuits via the old panel functioning as a large junction box. It is good practice to label the circuitry in the old panel "wire nut spliced" to the new feeder wires. Make certain that there is always access to both the new and old boxes. If the old entrance was via a conduit, seal it off to prevent entrance of air, water, or pests. The connections on any heavy up should be checked at least once in the following year.

X. An INCOMPLETE HEAVY UP means that the work remains incomplere with regard to the wiring to the main panel. Heavying up the power supply to a house requires a permit, and the job may take a while to coordinate. Often a house will be in the process of renovation for some time. The time period can be particularly extensive when underground feeds are replacing overhead lines. The permit and the final inspection should be completed before ownership is transferred. If no permit can be found, an inspection is necessary so the specific requirements are known. A profesional electrician should then complete the installation.

Generally, houses are not actually "rewired". What actually occurs is the panel is increased in capacity and additional circuits are run to those areas where they are needed.

Y. The percentage of **WIRING** that has been **UPGRADED** or **ADDED** refers to the extra circuitry added to the house above and beyond the original system. This is a rough approximation determined by visible wiring at the main panel and other visible clues throughout the building. The **YEARS AGO** category refers to the approximate age of the wiring upgrades. This will generally be a crude guess.

Za. The **ENTRANCE** refers to the material type of the wire connecting into the main panel. This does not refer to any wire that may lead from the weatherhead to the meter base.

Zb. The **MAJOR APPLIANCE** refers to the material type(s) of the conductors leading to the major appliances (range, dryer, AC, etc.) within the house.

Zc. The **GENERAL LIGHTING** refers to the material type(s) of the conductors servicing the outlets and receptacles, etc.

A1. CU indicates copper material while **AL** indicates aluminum.

It is very common today for the feed line from the street into the distribution panel to be aluminum and for the major appliance wiring to be aluminum as well. This is usually coupled with copper general lighting circuits to make what is generally considered a standard installation. Such houses will not be deemed aluminum wired houses. Aluminum wiring devices should be checked for tight fittings every year. The wiring should be coated with a low flame spread, low ignition point antioxidant. ("Penetrox A" does nicely.) Other repairs and upgrades are available.

B1. ROMEX refers to the plastic jacketed or flexible (non armored) jacketed cables.

C1. UNGROUNDED ROMEX refers to flexible wiring that does not contain an individual ground conductor within the system. "Rag" wiring, as this is sometimes called, provides no included way to run a ground wire to the distribution panel.

Frequently an amateur upgrade from two hole receptacles to three hole type will be left ungrounded or a ground will be run from the device to a local ground source. (Usually a piece of plumbing pipe.) Though local jurisdictions may vary, upgraded codes may require grounding of this type system to be done with individual ground fault devices.

D1. BX refers to the flexible armored cable, which utilizes metal jacketing as a ground.

E1. CONDUIT refers to tubing of various wall thickness through which insulated wire conductors travel. This also refers to flexible "greenfield" conduit.

F1. KNOB AND TUBE refers to a wiring type where individual conductors were separated and supported on porcelain knobs and penetrate wood pieces via porcelain tubes.

WARNING: Care must be taken not to damage the exposed insulation on these old wires and heightened risk occurs when splices are made to extend existing circuitry.

Generally speaking, knob & tube wiring systems are outmoded and excellent candidates for replacement. Naturally, such work is expensive. One of the idiosyncrasies of knob & tube wiring systems is that connections are generally not made within junction boxes and hence, are always suspect.

G1. GROUNDING refers to wire connections leading to the plumbing system, the gas piping system or to rods driven into the earth. (Sometimes under slabs in basements.) Local codes vary a lot as to what is permissible. Always check. Make sure the ground strap is always resecured to the plumbing or gas piping if any work is done on them. Periodically check an outside ground rod to be sure the strap is firmly attached or that the strap or rod hasn't been cut or loosened with a lawn mower, etc.

SPECIAL NOTE: Some gas companies do not want any grounding connections to the piping systems. Consequently, bonding straps are sometimes found cut in houses. It is not part of a visual home inspection to determine the appropriateness of grounding to gas lines. Contact the local gas company for their views.

Concrete encased electrodes are only occasionally used as grounds in houses. This is more common in commercial and industrial buildings.

MULTIPLE GROUNDING means that a grounding conductor may be wired to different sources of ground. These sources may include a rod driven into the earth, water plumbing, and gas piping. If these sources are properly wired to form a "grounding system" the risk of electrical shock is less than when a single grounding system is used. If, however, a portion of the grounding system is provided with its own independent grounding source, problems can develop that might make the electrical system dangerous. Moreover, some suppliers of natural gas do not allow gas pipes to be included in a grounding system. They fear that a voltage surge could damage their meter or cause a fire. Recommended practices are different in the U.S. and Canada. The home inspector does not trace the grounding system. Contact a practicing professional licensed electrician for complete assurance.

A central ground is typical of condominium or adjoining apartment type distribution systems. The home inspector will not be able to check this. The "?" indicates that the ground either has not been found or has not been determined.

H1. SURGE SUPPRESSOR(S) indicate that devices are installed either at the weatherhead or within or around the main panel to more safely deal with electrical "spikes" that may occur.

I1. LIGHTNING RODS refer to wired systems, which are intended to readily conduct lightning strikes to the ground. Check a lightning rod for security and integrity along all lines. If it has glass insulators on the rods and they are shattered, it generally means it has been struck. Replace glass insulators. Make certain that there are adequate earth rods.

NO TESTING OR REPORTING AS TO ANY PARTICULAR SYSTEM'S ADEQUACY IS INTENDED. This merely conveys the information that such a system (complete or incomplete) exists. Consult an expert as to the adequacy of the system, etc.

Useful upgrade(s) suggests upgrading with surge suppressors, lightning rods or both.

J1. GROUND FAULT INTERRUPT BREAKER(S) means that such devices (essentially quick tripping special circuit breakers) exist within the system. These are tested with their test buttons and if they fail to trip, they are reported as defective. Homeowners should test them monthly. Replace those which fail or perform intermittently. The various locations are delineated.

WARNING: These GFCI devices are sensitive and often fail. They typically won't trip but they leave power to the device. Relying on such a receptacle for protection may result in ELECTROCUTION. Replace failed GFCI devices immediately.

The locations indicate where GFCI devices have been found. Extended means that other receptacles or lights, fans, etc. may be on the GFCI circuit. Useful upgrade suggests upgrading with GFCI devices.

WARNING: Do NOT plug refrigerators or freezers into receptacles that are ground faulted. If the power becomes terminated, as often occurs in storms, etc., the food stored in the appliances may spoil. If food is left to thaw and spoil in a refrigerator or freezer it may smell so bad that the appliance is best thrown away.

EXTENDED/USEFUL UPGRADE:
When the ground fault interrupt breaker trips, it is not uncommon to find lights, receptacles, bath exhaust fans and even electric heaters shut off. As long as the circuit is not overloaded, this is of no more consequence than an inconvenience. It is recommended that houses without ground fault interrupt devices, add them. Ideally they will be added to those areas which present a realistic electrocution or severe shock hazard. These are exterior receptacles, bath, garage, kitchen, swimming pool and spa receptacles.

K1. PLUG DISTRIBUTION refers to the outlet distribution throughout the house. Older houses often have only one overhead light and one plug-in receptacle per room. MINIMUM means that modern life, with radios, TV, fans, etc. will be difficult, and such a system is prone to overloading.

L1. TYPICAL means that such a system was typical for the time. Thus, a very old house that has not been upgraded could easily have both the minimum and typical notations underlined.

M1. UPGRADED means that the original distribution has been supplemented.

WARNING: Upgraded wiring is often done by homeowners or amateurs. There is an increased possibility of problems existing and going undetected.

N1. In some cases, A "'TWO PRONG' TO 'THREE PRONG' ADAPTER" can be used to convert a receptacle for use with a 'Three Prong' plug. The adapter is supplied with a ground connector that must be secured to the receptacle box via the screw, which retains the receptacle cover. The ground connector may be either a forked metal strap that protrudes from the adapter, or a wire, which extends from the adapter. In either case the ground connector must be secured to the receptacle by an electrically grounded screw.

Sometimes the cable which services two hole receptacles does not contain a ground, hence, grounding would not only require changing the receptacles but connecting the third hole to a proper grounding conductor.

A three hole receptacle system should utilize the third hole for a continuous ground to the total system ground. The U.S. National Electrical Code (NEC) changed around 1962 to require three hole receptacle systems. Often houses built before that time, but fitted with three hole receptacles, don't have the third hole connected to ground. The receptacles have been updated but the ground has not necessarily been connected. This is very common where individual rooms, even entire houses, have been updated. The third hole should be grounded. If the wiring to the device contains a ground conductor, it is easy; if not, it is expensive. Local codes may vary, so consult them for guidance.

WARNING: A visual home inspection will not generally be able to determine the adequacy of wiring to receptacles per its grounding capability, etc.

COMBINATION refers to a building containing both two and three hole receptacles. NO REPRESENTATION IS GIVEN HERE AS TO THE EASE OF CONVERTING TWO HOLE TO THREE HOLE DEVICES. Consult with a professional electrician.

HIDDEN DEVICES/SWITCHES?:
Hidden devices refers to receptacles or other devices which may have gotten buried behind new drywall or when some other modification to the house took place.

Switches? refers to the home inspector not being able to determine the function of a switch or switches. Check these on the pre-settlement walk-through inspection.

O1. CLOSET LIGHTING: Sufficient clearance must be maintained between closet materials and incandescent lighting or overheating and fires can occur. Custom lighting refers to extra lighting that is obviously more than what was supplied with the original house. Multiple recessed fixtures are common custom lighting. Whether a circuit is extended or not depends on the number and wattage of bulbs used in the fixtures and the number of individual circuits available to power them.

While many older pools use 120 volt lighting incorporated within their shells, most newer pools utilize low voltage lighting as a serious shock/electrocution reduction measure. Retrofitting to low voltage is recommended when repairs/upgrades are made. NOTE: The voltage of pool lighting will not generally be determined via a visual home inspection. Always have a professional electrician check pool equipment and verify the presence of separate grounding wires, which bond equipment, pumps, timers, etc. to ground. Checking this is possible via a circuit check, which is beyond the scope of a visual home inspection.

P1. OUTBUILDING or YARD WIRING refers to wiring extending past the building proper. This is often amateurishly done and no representation as to its adequacy is given. Buried wires are supposed to be a particular type of wire and should be buried below a specified depth, but frequently they are neither.

Q1. LOW VOLTAGE/DC LIGHTING refers to other than complete line voltage lighting systems. Some residential systems utilize a bank of relays that connect to various switches and various lights via low voltage lines. This type of system is designed for convenience and multiple access controls. The lights themselves are usually fed via line voltage or may contain transformers. In any case, it is important to understand that the relays, transformers, and even the lighting fixture may fail. This may involve extra expense in replacement. The presence of such a system can complicate modernization and remodeling work.

A variety of supplemental power units are available. Batteries, generators, and photo voltaic units may be used in various combinations. The visual home inspection does not generally cover such units and no representations are made for them. You should check with an appropriate professional to understand them and to assess their condition.

Outside yard lighting systems are popularly becoming the DC (direct current) type, since these too require low voltage. Consequently, their wiring systems usually don't have to be buried as deep as line voltage units. As a result, the bulbs tend to have longer life and are inexpensive.

AUXILIARY/HEAT TAPE:
Auxiliary wiring is considered supplemental to normal systems. It may be a workbench circuit, outside flood lights, etc.

Heat tapes are wire-like devices that are designed to provide heat to pipes or freeze areas such as the eave edges of roofs, which are prone to ice damming. Naturally they must be plugged in to work. They should be checked before the onset of each winter. Many heat tapes are quite fragile and burn through. Check and be sure they are not wrapped over themselves. This often produces hot spots, which can cause the tape to burn through.

EXTRA CIRCUITRY RECOMMENDED:
Extra circuitry recommended means that the individual appliances should have individual circuits run to them from the main panel or that extra convenience receptacles should be added. This is quite common when window air conditioners are used in an older house, when a kitchen is "upgraded" but the garbage disposal and dishwasher remain on one circuit, or there is only one circuit for the kitchen countertop receptacles.

Descriptive/Maintenance

R1. SUBSTANDARD MAINTENANCE refers to a system that simply has not been kept up. Lights may be burned out, switches and receptacles broken, etc.

WARNING: Generally, a complete visual inspection is impossible and increased repair costs should be anticipated when a house has experienced substandard maintenance.

S1. AMATEUR WORKMANSHIP should always be interpreted as heightened risk. The wise and cautious home buyer will hire a competent professional to analyze what has been done and make necessary repairs. This is an extra concern since improper electrical work can be a FIRE OR SAFETY HAZARD.

T1. UNEXPECTED MINOR EXPENSES: Most home inspection clients choose a limited visual inspection, which focuses on discovery of major problems and does not attempt to make an exhaustive listing of minor problems. The notation here is intended to help inform the client as to what to expect for more minor expenses in this category.

U1. CHECK WITH AN ELECTRICIAN, CODE AUTHORITY, ETC. It is important that the home inspection client fully realize the limitations of a visual home inspection done by a home inspection generalist. There are specialists who will generally have greater expertise and experience in a single facet of the building sciences and in many cases such a qualified person will discern and/or discover things that the generalist will not. You can not expect to be informed to a specialist level by a generalist. If you wish additional or more specific information, it is recommended that you contract with the specialists listed here.

RULES TO LIVE BY:

NEVER DO ANY ELECTRICAL WORK UNLESS YOU ABSOLUTELY KNOW WHAT YOU ARE DOING:

A. Never replace a fuse with a larger capacity fuse.
B. Never provide temporary connections between circuits.
C. Never remove access covers from fuse panels without cutting off the power.
D. Always check the wire connections on garbage disposals, clothes dryers, etc. Appliances that vibrate can loosen the connection de vice and abrade the insulation on the wire.
E. Do not ignore repairs. A dead receptacle, light, or switch may mean a break in a wire that can short circuit and cause a fire.
F. Never check to see if a wire has power by quickly touching it with a dampened finger.
G. Never ignore trouble signs. Continuously blowing fuses, shrinking TV pictures, flickering lights, odors or heat from receptacles, sparks from appliances, etc.
H. Never stick an eating utensil, like a butter knife, in a toaster.
I. Avoid using electric heaters in bathrooms.
J. Know that a dropped electric razor, curling iron, or blow dryer can electrocute anyone in a tub or in contact with water in a basin.
K. Never stick anything into a receptacle other than a plug. Use child protector devices to cover receptacle openings.
L. Never insulate over lighting that recesses into a ceiling.
M. Never cover, fold, or tuck in an electric blanket unless otherwise stated.
N. Never use any tool that has shocked you. If outbuilding or exterior wiring provides a shock, have a professional fix it.
O. Don't run appliances unattended.
P. Keep curtains and the like clear of electric baseboard heaters.
Q. Never step into the water of a wet basement until you know the power is off.
R. Never install (or dismantle) a TV antenna within striking distance of the incoming wiring.
S. Never remove the ground probe from a three prong plug.

HOW ELECTRICAL TRAGEDIES HAPPEN:
Every year there are approximately 200,000 electrical fires in the U.S. with over 1,000 deaths and approximately $2,000,000,000.00 worth of damage. There are usually about 600 electrocutions yearly.

ELECTROCUTIONS OUTSIDE:
TV antennas, aluminum or wet ladders, and gardening machines strike outside power wires.

Old tools (damaged insulation or cords) used outside where a person standing on moist soil becomes a good conductor to ground.

ELECTROCUTIONS INSIDE:
Household appliances are dropped in water in the kitchen or bath and readily provide current through the person to ground. Standing barefoot in the bath with a damaged blow dryer is high risk.

FIRE SOURCES:
Light duty extension cords which have been used to feed power to large motor appliances or to heat producing appliances. Extension cords that are laid across stoves or under rugs. Fuses which are exchanged for larger ones, to "prevent" blowing the smaller one. Loosely made or spliced electrical connections which can heat up under a load. Push connection devices which "spit out" the wire insert and arc on contact. Old technology aluminum wiring which gets intermittent hot connections. Plugs which fit loosely into receptacles. Multiplex "convenience devices" which heat up under heavy loads. Wire insulation that is stripped bare during installation and short circuits. Stretching wires or pulling them through holes can cause this. Conductor insulation that gets slit when removing the jacket. Nail plates that are not installed and then later nailing pierces a wire. Recessed or "Hi Hat" lighting fixtures are covered with insulation (leave a 3 inch air gap) causing the device to overheat. (Some newer devices may not need this. They should be labeled accordingly.)

There are always unexpected minor repairs around a property. To avoid extra damage or expense, make repairs as soon as the need arises.