ELECTRICAL INSPECTION

SCOPE OF THE ELECTRICAL INSPECTION: 266CMR: BOARD OF REGISTRATION OF HOME INSPECTORS
266 CMR 6.00: STANDARDS OF PRACTICE:
6.05 System: Electrical:

(1) The ***Home Inspector*** shall ***Observe*** the ***Readily Accessible*** and ***Observable***:
- (a) Exterior of the exposed service entrance conductors.
- (b) Service equipment, grounding system, main over current device, interior of the main and distribution subpanels (by removing the service and distribution panel covers). However, the ***Home Inspector*** is not required to remove the covers if the panel covers are not ***Readily Accessible*** and or removal would damage any painted surface and or covering materials (however, it shall be the ***Home Inspectors*** responsibility to document the reason for not removing the panel covers in the ***Report***).
- (c) Amperage and voltage ratings of the service.
- (d) Exterior of the exposed branch circuit conductors, their over current devices, and the compatibility of their ampacities and voltages.
- (e) Operation of a representative number of permanently installed lighting fixtures, switches and receptacles located inside the house, garage, and on its exterior walls.
- (f) The number of branch circuits inside the panel(s) and the number of over current devices in the panel(s).
- (g) Whether all bathroom and kitchen countertop receptacles are ground fault protected.

(2) The ***Home Inspector*** shall ***Describe***:
- a. Service type as being overhead or underground, cable, encased in conduit, other.
- b. The type of service, feeder, and branch-circuit conductor materials (copper, copper clad aluminum, aluminum, other).
- c. The type of feeder and branch circuit wiring (Armored cable, conduit, tubing, nonmetallic cable, knob and tube, wire mold, other).
- d. The location of the service and subpanels and indicated whether they are ***Readily Accessible*** and ***Observable***.

(3) The ***Home Inspector*** shall ***Report on***
- (a) The size and the voltage of the main service disconnect (30, 60, 100, 125, 150 and or 200 amp, other service, 120, 120/240, 120/208-volt system).
- (b) The number of branch circuits in the panel(s) and the number of overcurrent devices in the panel(s).
- (c) Report any of the overcurrent devices that are in the off position and recommend the ***Seller*** and or the ***Sellers Representative*** demonstrate that those circuits are functional.
- (d) The exterior electrical service.
- (e) Aluminum wiring, report if the exposed and ***Readily Accessible*** and ***Observable*** conductor terminations are properly coated with a termination compound and if the overcurrent devices are identified for use with aluminum wire.
- (f) All undedicated exterior electrical receptacles and report polarity, grounding and ground fault protection issues (if any).
- (g) If the electrical system is attached to both the city and dwelling side of the water piping and or a ground rod.
- (h) Of the neutral and equipment-ground terminal bars and if they are properly attached (bonded) to the panel enclosures.
- (i) The compatibility of the overcurrent devices and the size of the protected conductor (Over-Fusing)1.
- (j) Report ground-fault and arc fault protection issues, if any, as determined by the required testing.
- (k) Report on any polarity or grounding issues of the receptacles tested.
- (l) The exposed and ***Readily Accessible*** and ***Observable*** branch circuit wiring.

(4) The ***Home Inspector*** shall:
- (a) Test the polarity and grounding of a representative sample of the three prong receptacles throughout the ***Dwelling***.
- (b) Test the polarity and grounding of all undedicated bathroom and kitchen countertop receptacles.
- (c) Test the polarity and grounding of all nondedicated receptacles in the attached garage and on the exterior of inspected structures and whether said receptacles are ground fault protected.
- (d) Test the operation of all Ground Fault Circuit Interrupters.
- (f) Test of the operation of all arc fault protective devices.

(5) The ***Home Inspector*** is **not** required to:
- (a) Collect engineering data on the compatibility of the overcurrent devices with the panel and or

determine the short circuit interrupting current capacity. (***Engineering services***).
1 Any overcurrent device exceeding the rated current ampacity of the conductor(s) being protected by the device.

(b) Determine and or report on the adequacy of the ground and or in place systems to provide sufficient power to the ***Dwelling*** (***Engineering/Electrical services***).

(c) Insert any tool, probe, or testing device inside the panels.

(d) Test or operate any over current device except Ground Fault Circuit Interrupters and Arc Fault Interrupters.

(e) Dismantle any electrical device or control other than to remove the covers of the main and sub-distribution panels. However, the ***Home Inspector*** is not required to remove the covers of the main and subpanels if the covers are not ***Readily Accessible***, when there are ***Dangerous or Adverse Situations*** or when removal would damage, mar any painted surface and or covering materials (however, it shall be the ***Home Inspectors*** responsibility to document, in the ***Report***, the reason for not removing the panel covers).

(f) ***Observe***, ***Describe*** and or ***Report On***:

1. The quality of the conductor insulation. (***Electrical Services***).
2. Any test for Electro-Magnetic fields. (***Electrical Services***).
3. Low voltage systems, door bells.
4. Smoke and Carbon Monoxide detectors (***Seller's*** responsibility).
5. Telephone, security alarms, cable TV, intercoms, or other ancillary wiring that is not a part of the primary electrical distribution system.
6. Underground utilities, pipes buried wires, or conduits. (Dig Safe).

DISCLAIMERS: The following items are expressly **EXCLUDED** from this report: low voltage systems, smoke & CO detectors, telephone systems, security systems & alarms, cable TV systems, intercoms, landscape lighting or other ancillary wiring that is not part of the primary electrical distribution system. The home inspector will NOT test all switches, receptacles or fixtures; a representative sample would be tested. The inspector will NOT remove switch or outlet cover plates, nor will he trace wiring origins or destinations. Outside pole lamps are **EXCLUDED** as the wiring is not *readily accessible.*

GENERAL COMMENTS: A. **Important Safety Note:** Repairs attempted by untrained or unlicensed individuals to any electrical component may result in injury or death from electric shock or create a future and/or hidden unsafe condition. It is recommended that all repairs or improvements be performed by a licensed electrician. Any electrical repairs attempted by the home owner should be approached with caution as personal injury or fire could result. The power to the entire home should be turned off prior to beginning any repairs, no matter how trivial the repair may seem. B. The MAIN DISCONNECT and individual circuit breakers or fuses were NOT opened or tested during the inspection for to do so would disrupt energized parts of the home and upset the owner. Upon occupancy and twice a year, you should trip the main breaker and circuit breakers as preventative maintenance. **C. Be advised that a 100 amp electrical service is now considered the modern minimum for all single family homes.** I recommend that all 60 amp services be retired unless gas major appliances are utilized. D. While older 2-slot outlets may be typical for an older home, they are rated as "poor" by the CPSA and updating to modern U-type receptacles is recommended for grounding safety. E. Be advised that modern homes now have outlets within 6 foot reach to prevent the use of extension cords. F. Be advised that ground-fault-circuit-interrupters (GFCI) are now required at all water hazard areas such as outside outlets, swimming pools, garage, basement, bathrooms and all outlets above kitchen countertops. Updating is advised if such devices are not present. G. Be advised that as of 2002, all new homes must have arc-fault-circuit-interrupters (AFCI) devices to protect all bedroom circuits from causing a fire. Older homes can be updated with such devices also. H. Be advised that all electrical equipment has a finite life of approximately 40-years, after which all components should be evaluated for age replacement. I. Any flush-mounted ceiling light fixture installed before 1985 has a potential for brittle insulation in the outlet box above the fixture. Further inspection is advised for fire safety. J. For more information on smoke detectors visit http://www.cpsc.gov/cpscpub/pubs/5077.html

1. TYPE OF SERVICE:

Type: Observation: The home has an overhead Edison 3-wire service with wires that run from a utility pole to the house.

2. SERVICE EQUIPMENT:

EXPOSED CABLE OR RACEWAY:

Observation: The service wires are enclosed within an exposed cable on the side of the building. The service entrance cable leads to the meter box. The cable & meter box belong to the home owner.
Analysis: While an exposed insulated cable is acceptable, enclosure in a metal or plastic raceway offers greater protection against cable deterioration caused by exposure to the elements and sunlight.

Recommendation: Monitor the cable for future fraying and have it replaced by an electrician as a frayed service cable may allow water infiltration. You should paint the cable to prevent fraying and maintain all waterproof connections with dux-seal.

METER LOCATION:

Observation: The home has an outside meter. (Note: The meter box belongs to the homeowner.)

MATERIAL OF SERVICE LINES:

The service entry materials are copper. (Note: Copper service wires indicate a quality service installation.)

LOCATION & TYPE OF MAIN SERVICE DISCONNECT:

Observation: The main circuit breaker disconnect is located at the top of the circuit breaker panel. The main panel is *Readily Accessible* and *Observable*.
(Note: The main service switch was NOT tested during the home inspection so as not to disturb the owner's timers, appliances, computers and lifestyle. You should test the main disconnect when you move into the home.)

AMPERAGE & VOLTAGE RATING OF MAIN DISCONNECT: 200 amps - 115 / 230 volts (Note: 100 amps is the required minimum service size.)

AMPERAGE RATING OF MAIN CIRCUIT PANEL: 200 amps. (Note: A 100 amp service equals modern minimum requirements for single family homes.)

LOCATION OF SERVICE PANEL: Basement.

OVERLOAD PROTECTION DEVICES (fuses or circuit breakers): **Circuit breakers**. (Note: Circuit breakers are a sign of a newer electrical panel. Be advised that circuit breakers should be manually switched on & off every six months to lubricate the internal parts.)

GROUNDING EQUIPMENT: (All conductive materials should be bonded.)

Observation: The main ground connection was not *readily accessible* at time of inspection.
Analysis: The condition of the main ground cable is undetermined.
Recommendation: When clearance or access is possible, you should make sure that the main ground cable is firmly attached to the street side of the water meter and that there is a jumper wire by-passing the water meter.

ANY SIGNS OF UNDERSIZED SERVICE?

Analysis: In my opinion, the electrical service size appears appropriate for this home.

ELECTRICAL SERVICE CONDITIONS: **** FUNCTIONAL with EXCEPTIONS. SEE NOTES BELOW:** (Note: Any electrical defects should NOT be taken lightly. Further evaluation by an electrician is advised to determine needed safety repairs or updating.)

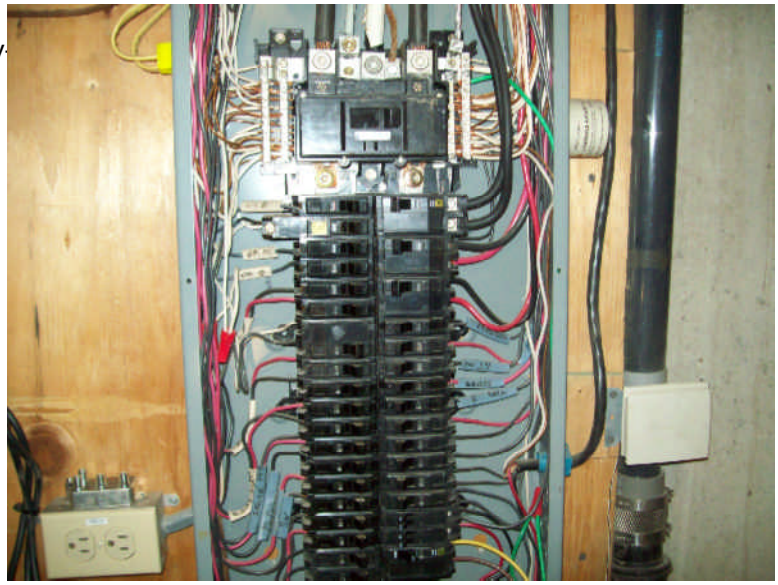
OUTDOOR SERVICE PROBLEMS:

Observation: The electrical service riser cable is close to a window.
Analysis: ****** UNSAFE** - someone could accidently come in contact with the electrical service wires when opening or maintaining the window. Exposed service cables must be a minimum of three feet from the left & right sides and bottom of a window to prevent accidental contact. Repair is needed.
Recommendation: I advise that you ask an electrician to reappraise the clearance distance between the window and the service wires and that an estimate be prepared for service wire relocation or encased in a PVC conduit.

Observation: As inspected from outside, the vertical electrical service entrance cable

or raceway on the siding is missing supportive clamps.
Analysis: A loose service cable could move and cause other connections to fail. Minor repair is needed.
Recommendation: Suitable clamps should be installed and spaced as required.

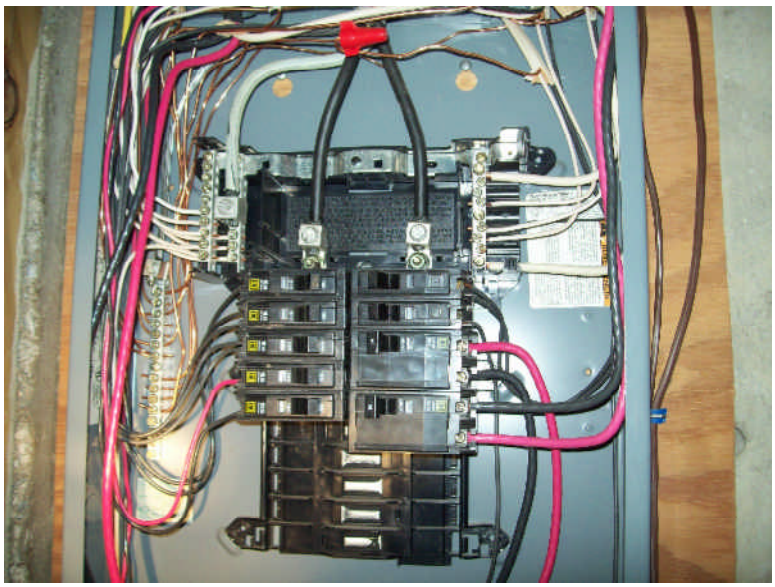
INDOOR SERVICE PANEL PROBLEMS:



Observation: Mini-back breakers or piggy-back breakers are present in the service panel.
Analysis: Breakers of this type are not to be used unless the panel is designed for them. Often such breakers are installed when space in the panel is limited, and no one wants to pay an electrician to install a larger panel or a subpanel. The mini-breakers may exceed the number of circuits in the panel specified by the panel manufacturer.
Recommendation: Further investigation by an electrician is advised. A larger panel may be needed.

3. SUB-PANELS:

LOCATION & CONDITION:



Observation: The home has a sub-panel that is located remotely from the main panel.
Analysis: This is not be a problem, but you should know where each fuse or breaker is located for future reference.

Observation: The electrical subpanel cover was removed for interior inspection and appeared **FUNCTIONAL**. No visible problems where *readily accessible*. Overload devices (fuses or breakers) appear to be compatible in size for the protected conductor wires.

4. BRANCH CIRCUIT CONDUCTORS:

NUMBER OF OVERCURRENT DEVICES IN THE PANEL(S):

Observation: In my opinion, the home has an ample number of circuits for household use.

NUMBER OF BRANCH CIRCUITS IN THE PANEL:

46.

TYPES OF EXPOSED BRANCH CONDUCTOR MATERIALS:

Observation: Copper wiring to branch circuits and aluminum wiring to major appliance circuits are present and functional. The ends of the aluminum conductors are coated with corrosion inhibitor.
Analysis: While total copper branch circuit conductors are more desirable, aluminum is a less expensive and acceptable alternative for appliance circuits to ranges, dryers and central air conditioners . The ends of the aluminum wires should coated with an anti-oxidant paste.

CONDITION:

* **FUNCTIONAL** where *readily accessible* and as viewed in unfinished areas. (Please understand that the inspector can NOT fully evaluate the wiring within finished walls, floors & ceilings as it is inaccessible.)

BRANCH CIRCUIT WIRING HAZARDS:

Observation: Inspection of the visible branch wiring in the accessible portions of the unfinished areas (basement, crawl space, attic, etc.) revealed the following problems:

**** Wires touch metal pipes. (**UNSAFE** - wires must be isolated from possible conductive metal pipes.)
**** Dead ended wires. (Could be energized by a switch. Have the wires removed.)
**** Bare insulation, (**UNSAFE** - potential for shock or fire.)
**** Open junction boxes, missing covers.

Analysis: Any problems or **UNSAFE** conditions or hazards with the branch wiring may be simple in nature but should not be taken lightly. Be advised that any defects in the branch wiring may pose a **RISK of SHOCK or FIRE.**
Recommendation: You should ask an electrician to reappraise all of the branch wiring to verify the above problems and to identify other defects not documented in this report. Request a bid for completing all repairs in accordance with the requirements of the electrical code.

Overcurrent devices in OFF position

Observation: Overcurrent devices were in the "OFF" position.
Analysis: Home inspectors cannot energize a shut-down overcurrent device and it may be shut-down for a reason. The condition of the shut-down overcurrent device is undetermined, further investigation is needed.
Recommendation: You should **ASK THE SELLER** of the **SELLER'S REPRESENTATIVE** to demonstrate those shut-down circuits as functional.

5. OUTLETS, SWITCHES, FIXTURES:

TYPES OF OUTLETS:

Observation: The home has modern U-type 3 hole receptacles.
Analysis: This is a positive feature.

CONDITION:

**** FUNCTIONAL with EXCEPTIONS.** Observation: Random sampling revealed that the outlets, switches & lights were FUNCTIONAL with EXCEPTIONS as noted below:

PROBLEMS:

Observation: Missing outlet or switch cover plates were noted.
Analysis: ****** UNSAFE -** While repair is simply a matter of installing cover plates where missing, the lack of a cover plate is **UNSAFE** as the user is exposed to alive parts and a shock hazard.
Recommendation: Install all missing cover plates NOW as required for safety.

6. GFI & AFCI DEVICES:

TYPE & CONDITION:

Observation: The older home lacks modern arc-fault-circuit-interrupters (AFCI) devices.
Analysis: An AFCI device is a new 2002 requirement for all bedroom circuits and is designed to prevent a fire.for new construction.
As of 2008, the National Electrical Code requirement for AFCI protection has been expanded: "Dwelling Units: All 120 volt, single-phase, 15- and 20- amp branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sun rooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by listed arc-fault-circuit-interrupter, combination-type, installed to provide protection of the branch circuit."
Recommendation: Consider **optional** updating. See CPSC publication below:

Arc Fault Circuit Interrupter
(AFCI)
FACT SHEET

THE AFCI
The "AFCI" is an arc fault circuit interrupter. AFCIs are newly-developed electrical devices designed to protect against fires caused by arcing faults in the home electrical wiring.

THE FIRE PROBLEM
Annually, over 40,000 fires are attributed to home electrical wiring. These fires result in over 350 deaths and over 1,400 injuries each year1. Arcing faults are one of the major causes of these fires. When unwanted arcing occurs, it generates high temperatures that can ignite nearby combustibles such as wood, paper, and carpets.

Arcing faults often occur in damaged or deteriorated wires and cords. Some causes of damaged and deteriorated wiring include puncturing of wire insulation from picture hanging or cable staples, poorly installed outlets or switches, cords caught in doors or under furniture, furniture pushed against plugs in an outlet, natural aging, and cord exposure to heat vents and sunlight.

HOW THE AFCI WORKS
Conventional circuit breakers only respond to overloads and short circuits; so they do not protect against arcing conditions that produce erratic current flow. An AFCI is selective so that normal arcs do not cause it to trip.

The AFCI circuitry continuously monitors current flow through the AFCI. AFCIs use unique current sensing circuitry to discriminate between normal and unwanted arcing conditions. Once an unwanted arcing condition is detected, the control circuitry in the AFCI trips the internal contacts, thus de-energizing the circuit and reducing the potential for a fire to occur. An AFCI should not trip during normal arcing conditions, which can occur when a switch is opened or a plug is pulled from a receptacle.

Presently, AFCIs are designed into conventional circuit breakers combining traditional overload and short-circuit protection with arc fault protection. AFCI circuit breakers (AFCIs) have a test button and look similar to ground fault circuit interrupter (GFCI) circuit breakers. Some designs combine GFCI and AFCI protection. Additional AFCI design configurations are anticipated in the near future.

It is important to note that AFCIs are designed to mitigate the effects of arcing faults but cannot eliminate them completely. In some cases, the initial arc may cause ignition prior to detection and circuit interruption by the AFCI.

The AFCI circuit breaker serves a dual purpose - not only will it shut off electricity in the event of an "arcing fault", but it will also trip when a short circuit or an overload occurs. The AFCI circuit breaker provides protection for the branch circuit wiring and limited protection for power cords and extension cords. Single-pole, 15- and 20- ampere AFCI circuit breakers are presently available.

WHERE AFCIs SHOULD BE USED
The 1999 edition of the National Electrical Code, the model code for electrical wiring adopted by many local jurisdictions, requires AFCIs for receptacle outlets in bedrooms, effective January 1, 2002. Although the requirement is limited to only certain circuits in new residential construction, AFCIs should be considered for added protection in other circuits and for existing homes as well. Older homes with aging and deteriorating wiring systems can especially benefit from the added protection of AFCIs. AFCIs should also be considered whenever adding or upgrading a panel box while using existing branch circuit conductors.

INSTALLING AFCIs
AFCI circuit breakers should be installed by a qualified electrician. The installer should follow the instructions accompanying the device and the panel box.

In homes equipped with conventional circuit breakers rather than fuses, an AFCI circuit breaker may be installed in the panel box in place of the conventional circuit breaker to add arc protection to a branch circuit. Homes with fuses are limited to receptacle or portable-type AFCIs, which are expected to be available in the near future, or AFCI circuit breakers can be added in separate panel boxes next to the fuse panel box.

TESTING AN AFCI
AFCIs should be tested after installation to make sure they are working properly and protecting the circuit. Subsequently, AFCIs should be tested once a month to make sure they are working properly and providing protection from fires initiated by arcing faults.
A test button is located on the front of the device. The user should follow the instructions accompanying the device. If the device does not trip when tested, the AFCI is defective and should be replaced.

AFCIs vs. GFCIs
The AFCI should not be confused with the GFCI or ground fault circuit interrupter. The GFCI is designed to protect people from severe or fatal electric shocks while the AFCI protects against fires caused by arcing faults. The GFCI also can protect against some electrical fires by detecting arcing and other faults to ground but cannot detect hazardous across-the-line arcing faults that can cause fires.

A ground fault is an unintentional electric path diverting current to ground. Ground faults occur when current leaks from a circuit. How the current leaks is very important. If a persons body provides a path to ground for this leakage, the person could be injured, burned, severely shocked, or electrocuted.

The National Electrical Code requires GFCI protection for receptacles located outdoors; in bathrooms, garages, kitchens, crawl spaces and unfinished basements; and at certain locations such as near swimming pools. A combination AFCI and GFCI can be used to satisfy the NEC requirement for GFCI protection only if specifically marked as a combination device.
Source: **<http://www.cpsc.gov/CPSCPUB/PUBS/afcifac8.PDF>**
Preventing Fires In Homes: **<http://www.cpsc.gov/CPSCPUB/PUBS/afci.html>**

7. OVERALL CONDITION / RECOMMENDATIONS:

ELECTRICAL SUMMARY:

In my opinion, minimal but **UNSAFE** electrical conditions were noted. While the problems may be simple in nature, electrical hazards should not be taken lightly, safety repairs are needed. Consult an electrician to further evaluate the system and to perform repairs as determined and in accordance with the requirements of the electrical code.