



U.S. CONSUMER PRODUCT SAFETY COMMISSION

4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814-4408

Record of Commission Action
Commissioners Voting by Ballot*

Commissioners Voting: Chairman Inez M. Tenenbaum
 Commissioner Thomas H. Moore
 Commissioner Nancy A. Nord
 Commissioner Anne M. Northup
 Commissioner Robert S. Adler

ITEM:

CPSC Publication No. 516, *Repairing Aluminum Wiring*
(Briefing package dated March 15, 2011)

DECISION:

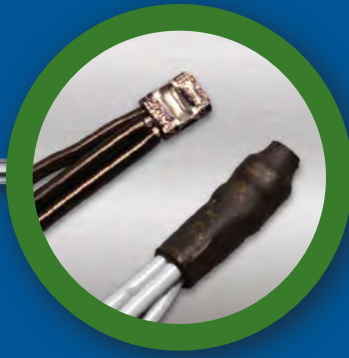
The Commission voted unanimously (5-0) to approve republication of CPSC Publication No. 516, *Repairing Aluminum Wiring*, with the explicit recognition that the COPALUM and AlumiConn connectors currently are the only products that meet the agency's standards to prevent aluminum wire fire hazards

For the Commission:

A handwritten signature in black ink, appearing to read "Todd A. Stevenson".

Todd A. Stevenson
Secretary

* Ballot vote due March 21, 2011



REPAIRING ALUMINUM WIRING



U.S. Consumer Product Safety Commission
Bethesda, MD
www.cpsc.gov
www.SaferProducts.gov

Publication 516

ALUMINUM WIRING

The U.S. Consumer Product Safety Commission (CPSC) staff and other government officials have investigated numerous hazardous incidents and fires throughout the nation involving aluminum branch circuit wiring. A national survey conducted by Franklin Research Institute for CPSC showed that homes built before 1972, and wired with aluminum, are 55 times more likely to have one or more wire connections at outlets reach “Fire Hazard Conditions”¹ than homes wired with copper. That survey encompassed only the wire connections at outlets. It did not address other types of aluminum wire connections and splices in homes that are also prone to fail. No information was developed for aluminum-wired homes built after 1972.

The fire hazard investigated by CPSC occurs at connections with aluminum wire, including receptacles or switches and junction boxes; or the hazards occur with major appliances, including dishwashers or furnaces, for example. There are several deterioration processes in aluminum wire connections that cause increased resistance to the flow of electric current, resulting in damage that is cumulative in effect. That increased resistance causes overheating, sometimes at hazardous levels, when current is flowing in the circuit.

A shortage of copper in the mid 1960s caused builders to increase the use of aluminum wire in residential electrical distribution systems from the few large-power circuits (i.e., for electric clothes dryers and ranges), to general purpose 15- and 20-ampere-rated circuits. Homes built before 1965 are unlikely to have aluminum branch circuit wiring. Electrical cables installed between 1965 and the mid 1970s in new homes, in additions, and as part of rewired/new circuits may contain aluminum wiring. On April 28, 1974, two people died in a home in Hampton Bays, N.Y. Fire officials determined that the fire was caused by an overheating aluminum wire connection at a wall receptacle.

¹ The survey conducted by the Franklin Research Institute defined “Fire Hazard Conditions” to occur when receptacle cover plate mounting screws reached 149°C (300°F), or sparks were emitted from the receptacle, or materials around the receptacle were charred.

TROUBLE SIGNS

Unfortunately, failing aluminum-wired connections seldom provide easily detected warning signs. Aluminum-wired connections and splices have been reported to fail and overheat without any prior indications or problems.

If you notice any signs of a problem, have a qualified electrician determine the cause. **DO NOT TRY TO DO IT YOURSELF.** You could be electrocuted, or you could make the problem worse. Signs of electrical system problems include hot-to-the-touch face plates on receptacles or switches; flickering lights; circuits that don't work; or the smell of burning plastic at outlets or switches.

IDENTIFYING ALUMINUM WIRING

Virtually all of the aluminum wiring was installed as plastic-sheathed cable (type NM, often called "Romex") with no readily discernable distinction from a cable with copper conductors. Look at the printed or embossed markings on the outer jacket of the electric cables, which are visible in unfinished basements, attics, or garages. If necessary, use a flashlight shining on the surface at a low angle to help make the embossed markings readable. Cable with aluminum conductors will have "Al"

or "Aluminum" and other information marked on one side of the cable jacket every few feet along its length. (Note: be sure to read as much of the marking as possible because the marking "CU-clad" or "Copper-clad," in addition to the "Al" or "Aluminum," means that the cable uses copper-coated aluminum wire and is not covered by the repair recommendations outlined in this publication).^{2,3}

If you are unable to identify the type of wire in your home by this method, but you suspect that you have aluminum wire, have a qualified electrician make the determination.

If your home has aluminum wiring that has not been remediated, CPSC recommends a permanent repair of the connections, as described in the following sections.

FIXING THE PROBLEM

Aluminum wiring can be replaced or repaired to effectively and permanently reduce the possibility of fire and injury due to failing (overheating) wire connections and splices. It is highly recommended that you hire a qualified electrician to perform this remediation.

Other than complete replacement of aluminum wire with copper wire, there may

² Aluminum and copper-clad aluminum cables are sized at No.10 and No.12 AWG for 15-ampere and 20-ampere-rated circuits, respectively, as opposed to No.12 and No.14 AWG for copper conductors.

³ The repairs outlined in this publication do not apply to larger gauge aluminum wire circuits and connections used for service entrance cables, electric clothes dryers, and cooking ranges.

be numerous potential solutions for the permanent repair of hazardous aluminum wire connections and splices. However, CPSC can recommend repair methods or products only where there is satisfactory, documented evidence that the methods or products meet the following criteria:

- **Safe.** The method or product must be safe and not increase the risk of fire or other hazards.
- **Effective.** The method or product must be effective and successfully eliminate or substantially mitigate the fire hazard.
- **Permanent.** The method or product must affect a permanent repair. Methods or products designed to address temporary or emergency repair situations, but which may fail over time, are not considered permanent.

Based on these standards, as of the date of this publication, CPSC approves of only three methods for a permanent repair.⁴

1) Complete Replacement of Copper Cable

2) COPALUM Method of Repair

3) Acceptable Alternative Repair Method/AlumiConn Connector

1) Complete Replacement with Copper Cable

Replacement of the aluminum branch circuit conductors with copper wire eliminates the primary cause of the potential hazards, the aluminum wire itself. Depending on the architectural style of your home and the number and locations of unfinished spaces (e.g., basements and attics), it may be relatively easy for a qualified electrician to rewire your home. A new copper wire branch circuit system would be installed, and the existing aluminum wire could be abandoned inside the walls. This is the best method available; but for many homes, rewiring with copper is impractical and/or prohibitively expensive.

⁴ Any individual or company that develops a method or product that meets these CPSC standards for a safe, effective, and permanent repair of aluminum wire connections and splices and desires that the CPSC consider recommending the method or product may submit documentation of compliance with such standards to: CPSC, 4330 East West Highway, Bethesda, MD 20814. Recommendation of products or methods is rare and is solely within the discretion of the CPSC. The burden and costs of establishing compliance with such standards is the responsibility of the requestor. Consideration of a product or method is not intended and does not create any right or benefit, substantive or procedural, enforceable at law or in equity, by any party against the U.S. Consumer Product Safety Commission or the United States, its officers, employees, or agents, or any other person.

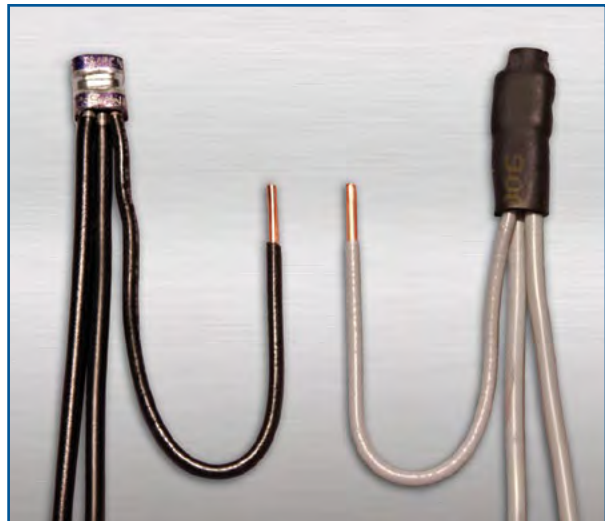
2) COPALUM Method of Repair

As an alternate to rewiring with copper, CPSC recommends attaching a short section of copper wire to the ends of the aluminum wire at connection points (a technique commonly referred to as “pig-tailing”), using a special connector named COPALUM to join the wires. CPSC staff considers pig-tailing with a COPALUM connector to be a safe and permanent repair of the existing aluminum wiring. The repair should include every connection or splice involving aluminum wire in the home, including outlets, dimmers, switches, fixtures, appliances, and junction boxes. The repaired system, with short copper wire extensions at every termination throughout the home, permits the use of standard wiring devices, including receptacles and switches.

The COPALUM repair method is recommended by CPSC on the basis of CPSC-sponsored research, laboratory tests, and demonstration projects. This repair method has been thoroughly proven by more than a quarter of a century of field experience to provide a permanent, low-resistance electrical connection to aluminum wire. The COPALUM repair method eliminates the aluminum connection failure problems and still uses the existing, installed aluminum wire. The COPALUM repair method has been shown to be practical for installation in an occupied and furnished home.

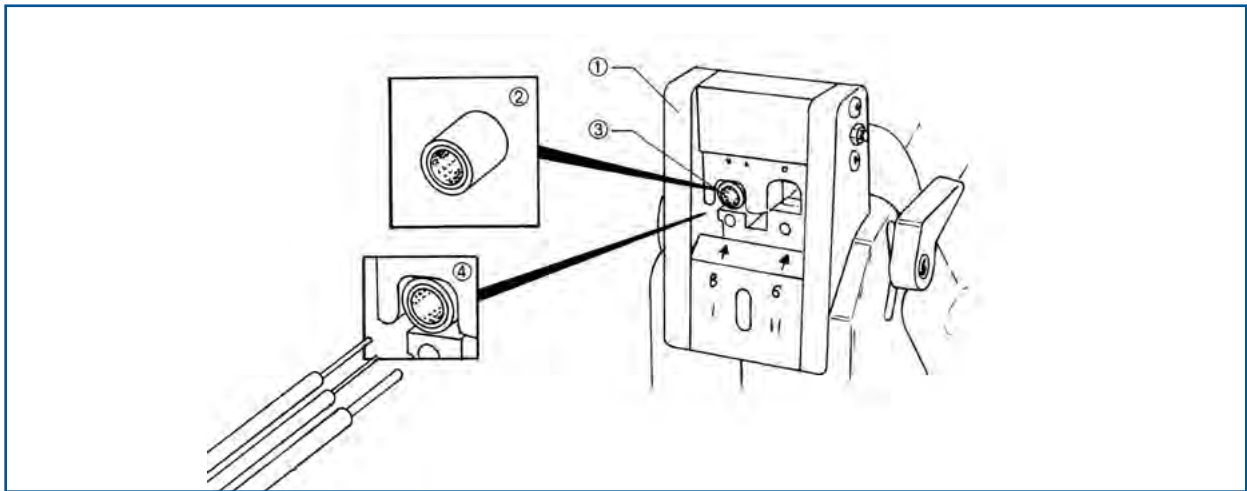
Every connection of aluminum-to-aluminum or aluminum-to-copper wire should be repaired in order to obtain the maximum benefit from such repair work. All appliances connected directly to No.12 or No.10 AWG aluminum branch circuit wiring (e.g., dishwashers, cooling equipment, heaters, air conditioners, and light fixtures) must be repaired in addition to wall outlets, switches, junction boxes, and panel boxes.

The COPALUM connector is a specially designed system that includes a metal sleeve intended to be installed only with a dedicated power tool and crimping die to make a permanent connection, that is, in effect, a cold weld (the precision dies in the COPALUM tool compress the connector and wires using upwards of 10,000 pounds of force, as required to make the permanent aluminum wire connection).

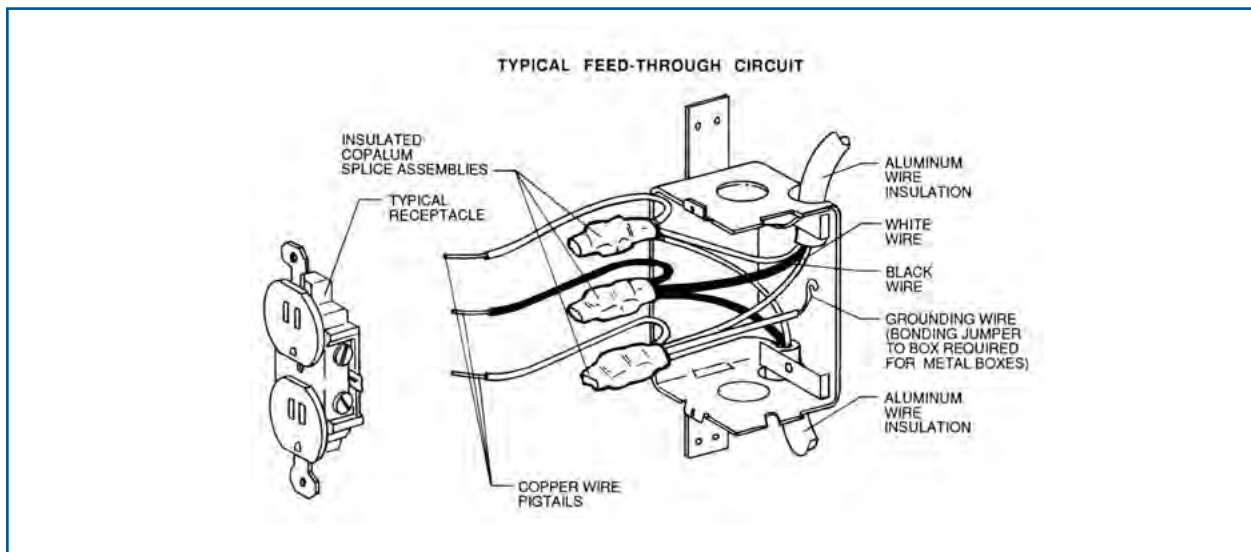


The tool is shown in the illustration below. An insulating sleeve is placed around the crimp connector to complete the repair. The copper wire pigtail is then connected to the switch, receptacle, or other termination device. An example of a repaired receptacle outlet is also illustrated below.

Only electricians who are trained by the manufacturer to use the tool properly are authorized to install COPALUM connectors. CPSC staff emphasizes that this training is necessary to ensure that the electrician uses the careful, professional workmanship and thoroughness required to make the crimp connector repair safe and permanent.



COPALUM Crimp Connector and its Specialized Installation Tooling



Recommended COPALUM Connector Repair

To determine if there is a COPALUM installer in your region, visit: http://tooling.tycoelectronics.com/copalum/copalum_home.asp, or contact the manufacturer at (800) 722-1111 or at the following address:

TE Connectivity
Attn: COPALUM Aluminum Wire Repair Program
P.O. Box 3608
Harrisburg, Pa. 17105

3) Acceptable Alternative Repair Method

CPSC staff recognizes that copper replacement may be cost prohibitive and that the COPALUM repair may be unavailable in a locality. Based upon an evaluation that was, in part, CPSC supported,⁵ consumers are advised that, if the COPALUM repair is not available, the AlumiConn connector may be considered the next best alternative for a permanent repair. This repair method involves pigtailing using a setscrew type connector instead of the COPALUM crimp connector in the repaired connections. The AlumiConn connector has performed well in initial tests, but is too new to have developed a significant long-term safe performance history as the COPALUM repair. The repair should be conducted by a qualified electrician because careful, professional workmanship and thoroughness are required to make the AlumiConn connector repair safe and permanent.



The AlumiConn Connector

For additional information on the AlumiConn connector, visit: <http://www.kinginovation.com/products/alumiconn>, or contact the manufacturer at (800) 633-0232, or write to the firm at the following address:

King Innovation
42 N. Central Drive
O'Fallon, Mo. 63366

RECOMMENDATIONS AGAINST USING OTHER REPAIR METHODS

Non-COPALUM Crimp Connectors

There are many other brands and types of crimp connectors – including those intended to be installed with a pliers-type of handtool – which are readily available to consumers at common retailers.

No other crimp connectors have been evaluated for connecting copper and aluminum conductors. CPSC staff strongly recommends against their use as a repair method.

⁵ CPSC's contractor self-funded the fundamental part of this research. The CPSC contract provided funds for additional longer term testing and recommendations requested in the CPSC contract.



Do Not Use Common Hand-Crimped Connectors with Aluminum Wire

Two other repair methods described below are often recommended by some electricians because they are substantially less expensive than COPALUM crimp connectors. CPSC staff does not consider either of these repairs an acceptable permanent repair.

Twist-on Connectors

The first temporary repair involves pigtailting with a twist-on connector. The effectiveness of “pigtailting” using twist-on connectors has been evaluated by CPSC staff. In CPSC-sponsored laboratory testing and life tests, substantial numbers of these connectors overheated severely.

Surveys of and statements made by electricians and electrical inspectors confirm the highly variable and often poor performance

of twist-on connectors with aluminum wire. It is possible that some pigtailting “repairs” made with twist-on connectors may be prone to even more failures than the original aluminum wire connectors. Accordingly, CPSC staff believes that this method of repair does not solve the problem of overheating present in aluminum-wired branch circuits.



“Pigtailting” with Twist-on Connectors Is Not a Recommended Repair

“CO/ALR” Switches and Receptacles

The other repair recommended by the industry is to use switches and receptacles labeled “CO/ALR.” These devices are intended for direct connection to aluminum wire, although they can be used with copper or copper-clad wire. CO/ALR devices perform better with aluminum wire than non-CO/ALR devices when

installed carefully and according to best electrical practices. However, CO/ALR wiring devices have failed in laboratory tests when connected to aluminum wire typical of that installed in existing homes. The test conditions simulated actual use conditions; no “overstress” type of testing was used. Further, CO/ALR connectors are not available for all parts of the wiring system (e.g., for the permanently wired appliances and ceiling mounted light fixtures). In the opinion of CPSC staff, CO/ALR devices must be considered, at best, an incomplete repair.

Recommendations on Temporary Repairs

AL/CU twist-on connector pigtails or CO/ALR devices may be used as an emergency, temporary repair for a failed aluminum termination. Should such a repair be performed, CPSC staff recommends that a complete repair of the aluminum-wired system be performed using the CPSC-recommended methods as soon as possible.

CODE COMPLIANCE AND INSPECTION

All modifications and additions to installed wiring should be performed and inspected in accordance with local regulations.

This pamphlet is available on the Web at: www.cpsc.gov/CPSCPUB/PUBS/516.pdf.

The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of serious injury or death from thousands of types of consumer products under the agency's jurisdiction. CPSC is committed to protecting consumers and families from products that pose a fire, electrical, chemical, or mechanical hazard. CPSC's work to ensure the safety of consumer products—such as toys, cribs, power tools, cigarette lighters, and household chemicals—contributed significantly to the decline in the rate of deaths and injuries associated with consumer products over the past 30 years.

To report a dangerous product or a product-related injury, visit: www.SaferProducts.gov, call CPSC's hotline at (800) 638-2772, or CPSC's teletypewriter at (301) 595-7054. To join a CPSC email subscription list, please go to: <https://www.cpsc.gov/cpsclist.aspx>. Consumers can obtain this release and recall information at the CPSC's website at: www.cpsc.gov.



INSURANCE COMPANIES

The following insurance companies accept all Consumer Product Safety Commission approved repairs, including the AlumiConn® Aluminum to Copper Lug:

Citizens Property Insurance

Philadelphia Insurance Companies

The Hartford Steam Boiler Insurance

Erie Insurance

CNA

Travelers Insurance

State Farm Insurance

Nationwide

Country Financial

The following insurance companies accept Consumer Product Safety Commission approved repairs on a case by case basis:

Chubb Corporation

American Family Insurance

USAA

Greater New York Insurance



Agent Informational E-Mail



Aluminum Branch Wiring

IE #008-11 – March 16, 2011

Effective 8/1/2010 and as announced in [Agent Technical Bulletin #005-10](#), the *Uninsurable Properties* section of the personal residential [Rules of Practice](#) was amended to clarify that potentially hazardous electrical conditions include properties with aluminum branch wiring circuits.

The rule change was to address concerns related to the original installation (1965-1972) of single-strand aluminum/solid aluminum wiring connected to the lower branch circuits (receptacles, switches, lights and small appliances). Homes with aluminum main service wires and heavier 240 volt circuits that feed major appliances (e.g., dryers, ranges, air conditioners) are eligible for coverage with Citizens.

Citizens has continued to research an acceptable remediation/repair for homes with aluminum branch wiring and currently accepts homes meeting at least one of the following conditions:

- The home has been rewired completely with copper wiring.
- All aluminum-to-copper connections (e.g., light fixtures, fan fixtures, outlets and switches) have been repaired via the COPALUM crimp method.
- All aluminum-to-copper connections (e.g., light fixtures, fan fixtures, outlets and switches) have been repaired via the AlumiConn® connector method.

Note: In all cases of aluminum branch wiring, Citizens requires that all aluminum branch circuit wire connections to the service panel must have been inspected and repaired as necessary to ensure no corrosion/oxidation is present and all connections are tight, before Citizens can insure the home.

An application for a home that has all aluminum branch wiring circuit connections remediated using one of the methods above may be submitted unbound to Citizens Underwriting for review. To establish eligibility for coverage, documentation from a Florida-licensed electrician confirming that all aluminum-to-copper connections have been repaired via the COPALUM crimp method or the AlumiConn connector method must be submitted. In addition, the property must meet all other eligibility requirements.

Agents and Customer Service Representatives may submit underwriting questions via the [Contact Us](#) option on our [website](#). You should receive a response within two business days.

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Agent Technical Bulletin



Personal Residential Rules and ePAS Changes

Effective 8/1/10

ATB #005-10 – June 9, 2010

The following changes apply to personal residential new business and renewal policies effective 8/1/10 or later. All [manuals](#) posted on the website have been updated to reflect these changes.

Uninsurable Properties for PR-M HO, DP, MHO and MDP Policies

Roof Rules

The PR-M roof rules are changing, effective 8/1/10, to mirror the personal residential wind (PR-W) roof rules announced in [Agent Technical Bulletin #008-09](#):

- Mobile homes with roof coverings more than 25 years old are not eligible for coverage with Citizens.
- Homes with roof coverings more than 25 or 50 years old, depending on the type of covering, are not eligible for coverage with Citizens as provided in the table below.
- Roofs that are damaged, have visible signs of leaks or have less than 3 years of remaining useful life are ineligible for coverage.

Roof Covering	Age
Asphalt, fiberglass, composition or wood-shake shingles; built-up tar and gravel; or other roof covering types not included below	More than 25 years old – not insurable
Tile, slate, clay, concrete or metal	More than 50 years – not insurable

Exception: A dwelling may be eligible for coverage if proper documentation is submitted verifying that the roof has at least 3 years of remaining useful life. Risks submitted under this exception must be submitted unbound for review. Proper documentation includes:

- Copy of a completed roofing contract
- Statement from a roofing contractor showing the estimated age, condition and remaining useful life
- Completed *Roof Condition Certification Form* ([CIT RCF-1 11 08](#))
- Other documentation deemed acceptable by Underwriting

How this change impacts current policyholders

If the roof covering material was indicated on the RCE, the information will transfer to the ePAS policy record. If the information was not provided on the RCE, roof covering on the policy record will be indicated as *unknown*.

All current policyholders will receive a notice with their renewal offer stating:

- The new roof eligibility rules
- The roof covering material indicated in the policy record
- Whether any action is required prior to their next policy renewal

Samples of the policyholder letters can be viewed by clicking on the links below:

- [Mobile/Manufactured Home – action required prior to next renewal](#)
- [Mobile/Manufactured Home – no immediate action required](#)
- [Roof covering type requiring update every 25 years – action required prior to next renewal](#)
- [Roof covering type requiring update every 25 years – no immediate action required](#)
- [Roof covering type requiring update every 50 years – action required prior to next renewal](#)
- [Roof covering type requiring update every 50 years – no immediate action required](#)

Heating and Electrical Rule

This rule was expanded to clarify that homes with aluminum branch wiring circuits, as well as knob-and-tube wiring, are not eligible for coverage.

ePAS Changes

In addition to ePAS application questions being amended or added to incorporate the rule changes outlined above, the following changes have been implemented in the system:

ePAS Wind-Loss Mitigation Defaults Change for PR-M and PR-W policies

Wind-loss mitigation (WLM) features no longer are defaulted to the least resistive feature. Instead, ePAS now shows **Select One** for each feature, and **Unknown** has been added to the drop-down list. When **Unknown** is chosen, ePAS will grant the least amount of mitigation credit available for that feature.

The WLM Defaults button is being relabeled as **WLM N/A Default**. When selected, fields not required for policy rating will change to **N/A** (not applicable) and all questions requiring a response will remain **Select One**. Building type determines which questions require a response.

General Tab: Existing Damage/Disrepair Question for PR-M policies

The existing damage/disrepair question will become 2 questions that read:

Does dwelling have any existing damage?

Existing damage description:

Is the property in a state of disrepair?

Risks with existing damage should be submitted unbound to Underwriting for review, along with the following documentation:

1. Description of the damage
2. Photos of the existing damage
3. Acceptable documentation stating when the repairs will be completed

Other Tab: Loss History for PR-M policies

The following question has been added to mirror the application. ePAS previously allowed entry of only the loss history information but did not allow entry of a yes or no response to this application question.

Has the applicant had any losses, whether or not paid by insurance, during the last 3 years at this or any other location?

As a reminder, applicants who have had 3 or more losses in a 36-month period (excluding acts of God) prior to the policy effective date or subsequent renewal, are eligible only for a DP-1 policy.

Agents and Customer Service Representatives may submit underwriting questions via the [Contact Us](#) option on our [website](#). You should receive a response within 2 business days.

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Reducing the Fire Hazards of Aluminum Wiring

The Problem with Aluminum Wiring: aka "Old Technology Wiring"

Aluminum wiring is typically found in 15 and 20 amp wiring connections in businesses, homes, and apartments that were built between 1965 and 1975. Aluminum was used because the cost of copper had increased dramatically. In 1972, manufacturers modified both aluminum wire and switches and outlets to improve the performance of aluminum wired connections.

There are problems associated with this wiring due to its brittleness, expansion properties, oxidation issues, and deformity when under stress, known as cold flow.

Because of these problems, the connections can become loose, causing electrical arc and ignition of nearby combustibles which may lead to fires. The Commission has also conducted research that shows that buildings wired with aluminum wire manufactured before 1972 ("old technology" aluminum wire) are **55 times more likely** to have one or more connections reach "fire hazard conditions" than a building wired with copper.

Reducing the Hazard

Currently Philadelphia Insurance Companies recognizes only **three** permanent solutions retrofitting Aluminum wiring. All repairs must be completed by a **licensed Electrician**:

In order of preference:

- 1. Discontinue the use of the aluminum circuit and rewire with copper wire. This is the preferred method.**
- 2. Use of COPALUM connectors-** Refer to figure 3. Install additional copper connecting "splice assembly" wires between the aluminum wire and the wired device (receptacle, switch, or other device). The connection must be made using only a special connector and special crimping tool licensed by TYCO /AMP Corporation (COPALUM Crimp Method).
Permanent repairs using TYCO Electronics / AMP COPALUM Crimp Method must be conducted by authorized electricians. These electricians are thoroughly trained by the manufacturer. This method, based on extensive testing, is the only method considered by the CPSC to be a permanent repair.
- 3. Use of ALUMICONN Connectors** – Refer to figure 4. This product was introduced in mid 2006 by King Innovation. If not adequately tightened, there is the possibility that connections could degrade. The manufacturer may be introducing a new holding tool for the field that will assist the installer in proper tightening.

IMPORTANT NOTICE - The information and suggestions presented by Philadelphia Indemnity Insurance Company in this Technical Bulletin are for your consideration in your loss prevention efforts. They are not intended to be complete or definitive in identifying all hazards associated with your business, preventing workplace accidents, or complying with any safety related, or other, laws or regulations. You are encouraged to alter them to fit the specific hazards of your business and to have your legal counsel review all of your plans and company policies.



Reducing the Fire Hazards of Aluminum Wiring

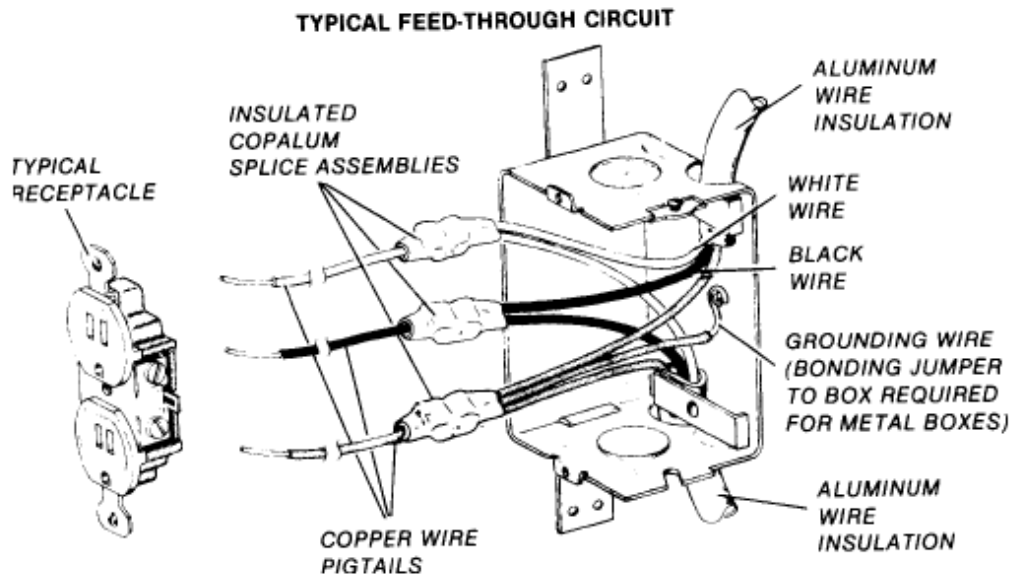


FIGURE 3 - Illustration of copper wire pigtails spliced to aluminum circuit wires using AMP* (Tyco) COPALUM connectors (Source: U.S. Consumer Product Safety Commission)



FIGURE 4 - King Innovation "AlumiConn" Connector

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LOSS CONTROL TECHNICAL BULLETIN

Bulletin
1400

Revised 3/17/08
Page 3 of 7

Reducing the Fire Hazards of Aluminum Wiring

Connections not approved by PIC Loss Control:

The Ideal #65 connector has had poor field results. CPSC has requested the UL withdraw its listing, thus this connector is no longer acceptable by PIC Loss Control.

The use of electrical receptacles and switches marked **COALR, CO/ALR, AL-CU or CU-AL** have not been recommended at this time by the US CPSC for aluminum wiring repairs. For that reason, PIC Loss Control does not recommend the use of these connectors.

What Should be Modified?

Every connection of aluminum-to-aluminum or aluminum-to-copper wire in your building should be repaired in order to obtain the maximum benefit of the repair work. Appliances connected directly to #12 and #10 AWG aluminum branch circuit wiring (i.e. dishwashers, cooking equipment, heaters, air conditioners and light fixtures) must be repaired in addition to wall outlets, switches, junction boxes, and panel boxes. Aluminum wiring is still permitted and used for certain applications, including residential service entrance wiring and single-purpose higher amperage circuits such as 240V air conditioning or electric range circuits.

All electrical modifications and additions must be in accordance with local regulations and inspected by municipal authorities.

Identifying the Hazard

Identifying the aluminum-wiring hazard is the first step towards fixing the problem. The following simple steps can be taken to assist you in determining if aluminum wiring is present: (It is recommended that a licensed electrician make the determination)

1. **Determine when was the building or house built or re-wired, or when new circuits added?** Buildings built, rooms added, circuits rewired or added between 1965-1973 may contain aluminum wiring.
2. **Don't assume that there's no aluminum wire** if your building was *not* built during these years. Circuits may have been added, extended, or modified using aluminum wiring. Or an installer may have had leftover aluminum wire and used it after these dates.
3. **Don't assume there's no aluminum wire** just because you find none in the panel. Aluminum may have been used for part of circuits or for some but not other circuits in the building.
4. **At outlets and switches, look at stripped wire ends.** Oftentimes, simply removing the cover plate will give sufficient view. Be especially cautious if you see back-wired receptacles. It may be difficult to see if the wire is aluminum, but if it is, the smaller wire contact surface when this method was used may increase the risk of overheating or other failures.

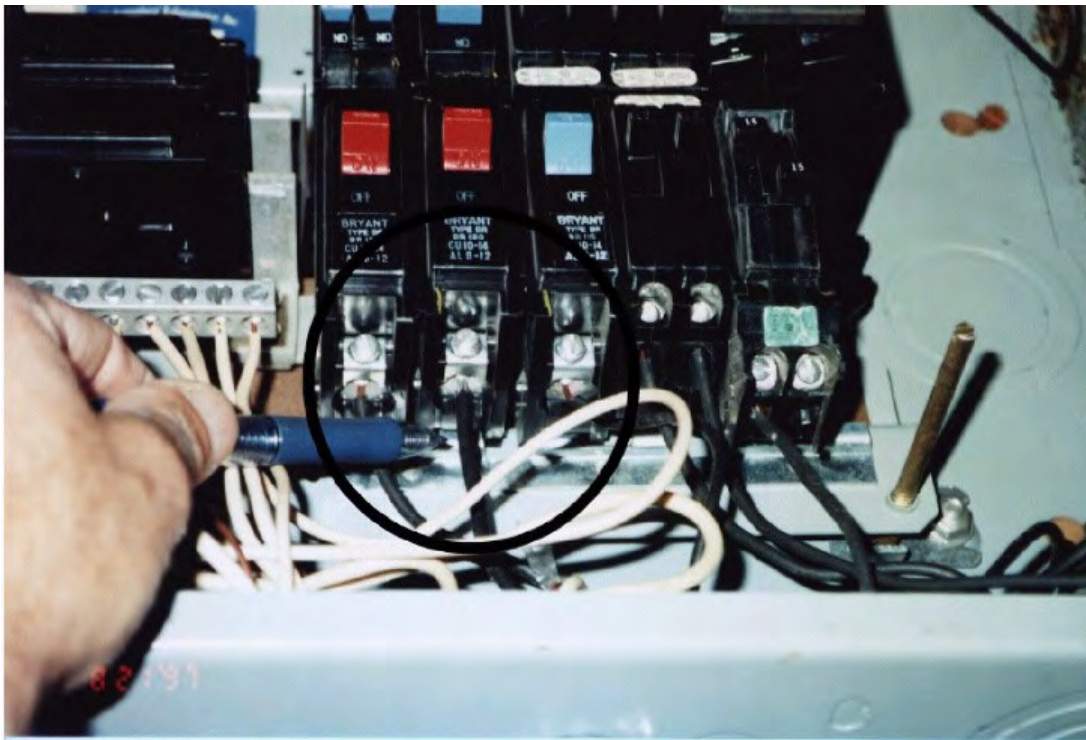
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Reducing the Fire Hazards of Aluminum Wiring

5. **Look at wire at circuit breakers in the electric panel for aluminum wire.** (See Figure #1). The pen in the circled area points to bare silver-colored wire visible at the circuit breaker. Notice that the aluminum wire in this photo is a single circuit installed between two copper wires (on adjacent breakers).

FIGURE #1



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Reducing the Fire Hazards of Aluminum Wiring

6. **Look for the word "Aluminum."** (See Figure 2). Look for printed or embossed letters on the plastic wire jacket where wiring is visible or at the electric panel. Some aluminum wire has the word "Aluminum" or a specific brand name such as "Kaiser Aluminum" plainly marked on the plastic wire jacket. This photo shows a dark colored wire jacket with green print indicating "Kaiser Aluminum." Some white colored plastic wire jackets are inked in red; others have embossed letters without ink and are hard to read. Try shining a light along the wire.

FIGURE #2



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Reducing the Fire Hazards of Aluminum Wiring

7. **In an area where the wire is visible, such as an attic, look at the wire gauge or "size."** Look for #12-gauge wires in the attic or other places where wiring is readily available. If you see only #12 and no #14, look further. Aluminum wire must be one wire gauge size larger for a given circuit than if copper was used. So while #14 copper wire is permitted on a 15-amp electrical circuit, if aluminum wire was used for the same circuit it would have to be #12. Similarly, a 20-amp circuit uses #12 copper wire or #10 aluminum wire. Common residential lighting and electrical-receptacle circuits are 15-amp or possibly 20-amp (e.g., in a kitchen). So if you see only #12 or larger wires in the attic of your house look further to see if it's aluminum. The wire gauge size is printed or embossed on the wire jacket. #12 does not guarantee it's aluminum, it's just more data to point in that direction.
8. **Look at bare wire exposed at the neutral bus.** An easy place to look for aluminum wiring (other than at the circuit breakers) might be at the neutral bus where both white neutral wires and ground wires are connected in a row. At the neutral bus it's easier to see exposed portions of the wire itself.

Loss History Involving Aluminum Wiring

A fundamental principle of electrical safety for wiring in buildings is that high temperatures are hazardous. While some protection is provided by electrical enclosures, high temperatures can develop at failing branch circuit connections can lead to fire in many ways. Aluminum-wired connections have been found to have a very high probability of overheating compared with copper-wired connections. The aluminum-wired connections that fail tend to progressively deteriorate at a slow rate, and after many years can reach very high temperature while still remaining electrically functional in the circuits. A large number of connection burnouts have occurred in aluminum-wired buildings.

There have been many fires caused by aluminum wiring, some involving injury and death. The most well known fire resulting in the loss of life and property occurred 21 years ago on the night of May 28, 1977. A devastating fire swept through the Beverly Hills Supper Club in Southgate, Kentucky. The fire was discovered shortly before 9 p.m. and burned most of the night. It killed 165 people. In the coming weeks, months and years, another horror would become apparent: The deaths could have been prevented.

The official investigation into what caused the fire at the Beverly Hills Supper Club was inconclusive, but the factor most often cited is aluminum wiring. A federal jury in Ashland agreed, ruling in July 1985 that aluminum wiring caused the fire. Attorneys and their experts sifted through the debris at Beverly Hills and found the aluminum wiring, which had been installed in the club in 1970 and 1971. They learned that aluminum wiring could pull away from its connections and ignite nearby materials if it didn't have the proper receptacles. They also produced dozens of documents during the trial in 1985 that indicated aluminum wiring made before 1973 was faulty.

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LOSS CONTROL TECHNICAL BULLETIN

Bulletin
1400

Revised 3/17/08
Page 7 of 7

Reducing the Fire Hazards of Aluminum Wiring

Further information and Resources:

Reducing the Fire Hazard in Aluminum Wired Homes – Dr. Jesse Aronstein, Revised May 21, 2007

<http://www.inspect-ny.com/aluminum/alreduce.pdf>

Repairing Aluminum Wiring - US Consumer Product Safety Commission (CPSC) Publication #516

<http://www.cpsc.gov/cpsc/pub/pubs/516.pdf>

Information on the AlumiConn connector

<http://www.kinginnovation.com/products/alumiconn.html>

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ALUMICONN[®]

ALUMINUM TO COPPER LUG

Aluminum to Copper (AL-CU)

**Consumer Products Safety Commission (CPSC)
Approves AlumiConn[®] as a long-term repair
method for aluminum wiring**



Catalog #	Selling Unit
95104	Clam of 2
95110	Clam of 10
95125	Bag of 25
95135	Box of 100
95145	Box of 1000

AlumiConn Aluminum to Copper Lug

SUPERIOR QUALITY THROUGH...

- **Secure, mechanical connection of conductors**
- **Provides more safety**

UL LISTED INSTALLATION INSTRUCTIONS

IMPORTANT: Turn off power before installing or removing connector.

Product to be used in accordance with local and national codes.

1. Strip conductors 5/16".
2. Insert conductor into wire port, fully seating conductor into port.
3. Tighten set screws to the torque indicated below, based on conductor size and material as indicated.
10 in-lb #12 solid aluminum
15 in-lb #10 solid aluminum
15 in-lb all solid and stranded copper conductors

Do not over torque.

4. Once all conductors are installed, close lid taking care to verify latch is securely fastened.

300V WIRE SIZES

#12 - #10 Solid Aluminum

#18 - #10 Solid and Stranded Copper



UL 486C Listed to meet U.S. and Canadian specifications as a Pressure Screw Type Wire Connector

PRODUCT SPECIFICATIONS & MEASUREMENTS

Max. Voltage: 300V

Wire Type: Copper/Aluminum

Wire Range: Min #18/Max #10

Temperature Rating: 105°C

Flammability Rating: V-2

Do not reuse

One conductor only per port

3A. MANUFACTURER APPROVED ALTERNATE TORQUE METHOD FOR USE ON SOLID WIRE ONLY.*

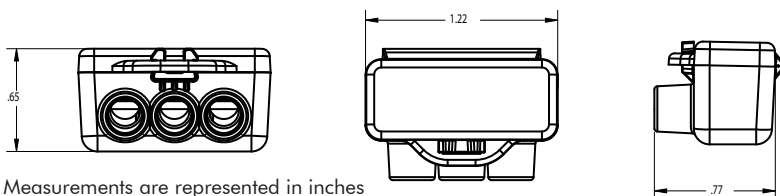
Using a screwdriver, tighten set screw until it comes into contact with the solid conductor.

Note location of screwdriver slot and continue tightening the set screw as indicated below:

1 full turn #12-#10 solid aluminum

1/2 turn #18-#10 solid copper

*Alternate torque method is not associated with UL listing above.



Measurements are represented in inches

KING
INNOVATION[®] Made in U.S.A.

www.kinginnovation.com

(P) 800.633.0232

(F) 636.519.5410

AlumiConn® Aluminum to Copper Lug

Aluminum to Copper (AL-CU)

- **Three ports allow conductors to remain separate, permitting the lug to:**
 - **Provide lower resistance, therefore lower temperature**
 - **Provide longer-term reliability**
- One piece for easy installation
- Secure, mechanical lug designed for aluminum to copper (AL - CU) connections
- AlumiConn design features a tin plated lug with three ports and nickel-plated compression screws
- Versus other products designed for aluminum to copper conductors, AlumiConn:
 - Is a more cost-effective alternative for replacing aluminum electrical wire systems
 - Offers a solution that makes pig-tailing easier and safer
- AlumiConn is suitable for multiple types of connections including:
 - Aluminum to Aluminum
 - Aluminum to Copper
 - Copper to Copper
- Ports of connectors contain a layer of Corrosion Inhibitor that provides resistance from oxidation.

Typical installation of a copper pigtail.

Note: AL= Aluminum, CU= Copper. Also note that the 'power out' is optional and not always applicable, depending on how your wiring is set up.

