The V

A look at terms used in home inspection reports

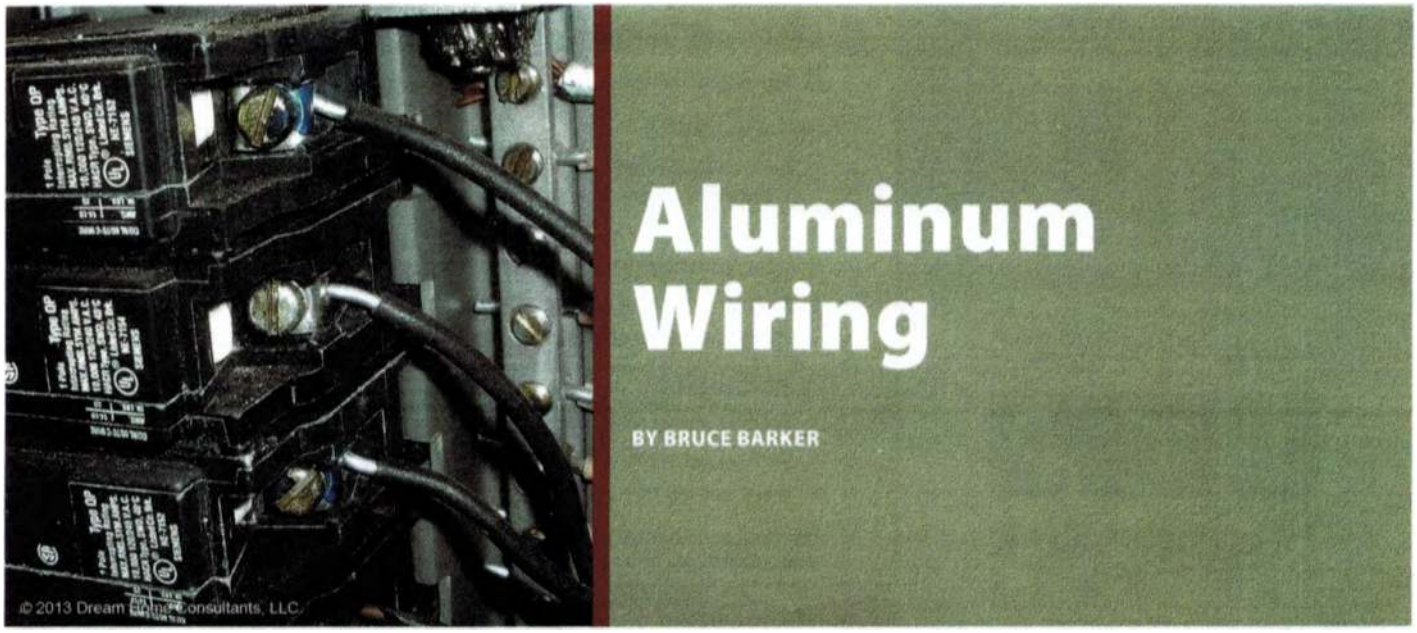

Photo I

ONCE AGAIN THE WORD INVITES YOU TO TRAVEL into the dark realm of subjects that are sometimes misunderstood by home inspectors. The Word hopes you will find this trip informative and maybe a little entertaining.

The Word's topic this month is aluminum wiring. The Word finds this topic interesting because there is a lot of controversy and mis-information out there about this material. Maybe we can clear up some of this and provide our clients with information they can use to make decisions about homes with this material. Let's start by setting the scene *for* our story.

A Good Idea Gone Bad

Around 1964, somebody had what must have seemed like a good idea at the time. Copper had become really expensive, so why not make solid-conductor aluminum building wiring out of aluminum? After all, aluminum wire had been used for years to transmit and distribute electricity, and had even been used in some building wiring. And so in 1964 they started making solid-conductor aluminum wiring in some #8 12 AWG non-metallic sheathed cable intended for residential use. See Photo 1.

The problem was that buildings are different from the electrical transmission and distribution grid. Buildings have lots of devices like switches, receptacles and circuit breakers. There are copper wires, such as in light fixtures and appliances, that need to connect to the aluminum wires. The building world was designed for copper wires. Apparently nobody considered the problems that could occur when you throw aluminum into this copper world. This is where our story of aluminum wiring begins.

Metal Mash-Ups

Many, if not most, metals we use every day are not pure forms of the metal. They are a mash-up of other materials. The more common term for these mash-ups is alloy. The materials in an alloy can significantly alter how the metal behaves. In the case of solid-conductor aluminum wire, the original alloy made the wire brittle and creepy. We'll define creepy in a moment.

Joule's Law

Another character in this story is our old friend Joule's Law. Regular readers will remember this from a previous column. This law tells us that heat in an electrical circuit is based on the amount of current flowing, the resistance in the circuit, and time. Increase resistance and you increase heat. Increase heat and bad things can happen. The plot thickens.

Connections Most Foul

The final character in this drama includes another old friend, the galvanic reaction. When different metals are in contact in the presence of moisture, electricity may flow. This is a good thing because without it, there would be no batteries. If electricity flows where not intended, like between copper and aluminum wires or between aluminum wires and steel terminals intended for copper wires, corrosion can occur.

Aluminum, like other metals, has a tendency to oxidize. Think of oxidation as rust. Oxidation or corrosion on wires (especially on aluminum wires) increases resistance at connections such as receptacles and switches. Resistance increases hear. Heat causes bad things.

Things Get Creepy

One property of the aluminum alloy used in the original, old technology—solid-conductor aluminum wire—is that it expanded more than copper when the wire got hot. It also expanded at a different rate than the steel device terminals designed for copper. This property caused a couple of problems. One problem was that expansion and contraction caused the wire to work loose at connections. This was especially true for receptacles and switches connected from the back instead of using the side screws. Loose connections equal higher resistance and arcing. This can't be good.

The other problem was that over multiple expansion and contraction cycles, aluminum wire at the connections would become distorted and smaller—permanently. Some call this problem cold flow while others call it creep. Creepy aluminum wire is effectively a smaller-gage wire. Running the same current through a smaller-gage wire increases heat. A new aluminum wire alloy was introduced in 1972 to replace the creepy aluminum alloy. By 1981 this more stable alloy was required for all aluminum wires By around 1980, though, solid-conductor aluminum wire had gotten such a bad reputation that nobody wanted the stuff. Manufacturers stopped making it. So far as The Word can tell (except for some solid conductor #8), there are no current sources in the United States.

Close, but No Cigar

As it turned out, terminals on devices that were designed for copper didn't play well with aluminum wire. One attempt to fix this problem was devices labeled CU! AL, but these devices didn't work either. The next attempt was devices labeled CO/

ALR. These devices work and have been required by the National Electrical Code (NEC) since 1981.

The Fixer

Problems demand solutions, so solutions were developed. The safest and possibly the best solution is to rewire the house with copper wire, but nobody wants to hear that. It's expensive and disruptive but worth considering.

Another solution is the COPALUM connector. This uses a patented connector and crimping tool to "cold weld" copper wire to aluminum wire. This process has been around for years and is recommended by the Consumer Product Safety Commission (CSPC). The problems include the fact that it's expensive, partly because the materials and tools are proprietary, and because electricians must be trained to use them. Every outlet (meaning switch, receptacle, light and appliance) with solid-conductor aluminum wiring must be repaired. At up to $60 or more per outlet, this gets expensive. Finding an electrician who can do this may be difficult, at any price.

A newer connector, called AlumiConn, has been available for about ten years. It's much less expensive than the COPALUM connectors and AlumiConn connectors are sold to the public. Selling to the public isn't necessarily a good thing. An inexperienced person could do more harm than good when installing these connectors. The CSPC endorsement of AlumiConn connectors is tepid at best, which may or may not mean anything.

What about replacing all the switches and receptacles with CO/ALR devices? This might help the situation with aluminum wire made after 1972, but this solution doesn't address the creep problem of old technology aluminum wire. This solution also doesn't address other aluminum wire terminations such as circuit breakers and light outlets.

No Worries

Aluminum wire has a really bad reputation, but it's important not to paint all aluminum wire (and wire that looks like aluminum wire) with the same brush. Stranded aluminum wire is available in AWG sizes 8 and larger and used for large appliance branch circuits and service entrance and feeder wires. This wire has no problems when installed with devices labeled CO/ALR and circuit breakers labeled CU/AL. Because of aluminum's tendency to oxidize, using anti-oxidant paste at terminals is highly recommended. Anti-oxidant paste is also highly recommended where aluminum and copper wires are connected together. Anti-oxidant paste is not, however, specifically required by the NEC. It is recommended by some wire manufacturers and required by some jurisdictions.

Copper-coated aluminum wire was produced in the 1970s. It looks like copper wire except you can see the aluminum wire where the wire is cut. This wire does not share the same problems as solid-conductor aluminum wire and has not been a problem. It's also rare, which may explain why there have been no reported problems.

"Tin"-coated copper wire was most popular in the 1940s and 1950s. You could find it in older houses too and houses built as late as the 1960s. See Photo 2. It looks a lot like solid-conductor aluminum wire, but there are some ways to tell the difference. The age of the house is one way. Houses built before 1964 might contain solid-conductor aluminum wire, but it's unlikely. Another way is to look carefully at where the wire is cut; you can see the copper there. Still another way is to look at the insulation. If the insulation is plastic, it's not tin-coated copper.

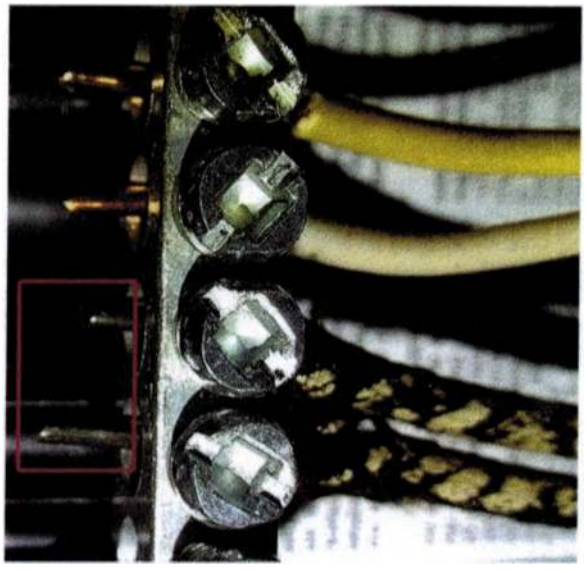

Photo 2

All tin-coated copper wire is near the end of its expected service life. The old rubber insulation can crack and fail, especially when disturbed.

Reporting Solid-Conductor Aluminum Wire

The current ASHI Standard of Practice (SoP), and most state standards, require that you report the presence of solid-conductor aluminum wire. Doing so without some explanation does no good. Briefly explaining the potential fire safety concern and urging your client to read CSPC publication 516 is a good way to report about this issue. The website is www.cpsc.gov/cpscpub/pubs/516.pdf . For your information junkie clients, Dan Friedman's website contains a lot of good information. It might be too much information for some. The website is http://www.inspect-ny.com/aluminum/ . You should also recommend that your clients contact their homeowner's insurance company. Some won't insure homes with aluminum wiring and charge more.

The proposed ASHI SoP deletes the requirement to report the presence of solid-conductor aluminum wiring. The reason for this is philosophical. The Standards Committee believes that it is

inappropriate to single out one problem component for special treatment. if reporting solid-conductor aluminum wire is required, why not require reporting polybutylene pipe, or E!FS, or LP siding, or Federal Pacific panels, or any and all known problem components? Where do you draw the line The proposed standard also, for the first time, specifically excludes from scope reporting products that have been recalled and products with known problems. A requirement to report one type of problem component is inconsistent with this exclusion.

Deleting the solid-conductor aluminum wire reporting requirement does not necessarily mean you should stop reporting it, especially for homes built between 1964 and about 1974. The extra two years beyond 1972 is to allow for installation of existing old technology wire.

What Should You Recommend?

The follo'ii..j is The Word's opinion; there no doubt are other valid ones. Evaluation of the electrical system by an electrician who has knowledge of and experience with solid-conductor aluminum wiring is a prudent recommendation for homes built between 1964 and 1974. The exception is where the seller can produce evidence that a qualified electrician has performed a recommended remediation method. For homes built after 1974, following the reporting recommendations in the previous section should suffice. The risk in these homes is less and it's appropriate to recognize this fact.

You should not recommend an evaluation or remediation technique. The appropriate technique is based on information that is not available to us; thus any recommendation would be an inappropriate guess.

Th. Bottom Lin.

Our job is to provide clients with information that they can use to make good decisions. The presence of solid-conductor aluminum wiring certainly qualifies. The trick is to report this information in a way that informs the client without causing unnecessary alarm. Come to think of it, that's the trick for everything we report.

This column contains material from Mike Casey, Mark Cramer and Douglas Hansen. The Word thanks these wise men who reside further up Mt. Olympus than does The Word.

Memo to Zeus: The Word does not reside on Mt. Olympus (just at its base) and welcomes other viewpoints. Send your lightning bolts or emails to Bruce@DreamHomeConsultants.com . The thoughts contained herein are those of The Word. They are not ASHI standards or policies. U

Bruce Barker operates Dream Home Consultants. He has been building and inspecting homes since 1987 He is the author of 'Everybody's Building Code" and currently serves as chair of the AS/-il Standards Committee. To read more of Barker's articles, go to www.dreamhomeconsultants.com

Correction: There were errors in the December article of The Word: HVAC Forced-Air Ducts made by The Reporter. The corrected article is available online at htrp://www.ashi org/Homelnspection/ Articles/H VAC-Forced-Air-Ducrs/4606. We apologize for any inconvenience this may have caused.

P Twitter Tips for You

ASHI staff received the following 'Writing for Twitter" tips from Gibbs & Soell, ASHI's Public Relations consultants. Members who are building a Twitter presence may find them as helpful as staff did. Look forward to more social media tips in future issues.

Tips for Twitter

- It is unlikely you will be able to entirely recreate a headline with Just 140 characters, so summarize. Tease the content of the article with Just a few words.
- Link to other Twitter handles when possible as it increases the chances that organization/person will retweet and share the message with their followers as well.
- Utilize hashtags (a link added to a tweet to connect it to similar tweets using the same link) whenever appropriate. Hashtags do not need to be created or registered, but if enough people begin using it, it will gain in popularity and become a commonly used link. Refrain from using too many, though, as it can be confusing for readers.
- Grammatically, writing for Twitter is similar to writing for a publication. Typos and errors can hinder credibility and might not be taken seriously. Though shortcuts are appealing when only having 140 characters to work with, the audience might find it unprofessional.
- When including links, use HootSuite's link-shortening application to reduce the number of characters used and to enable click-through tracking.