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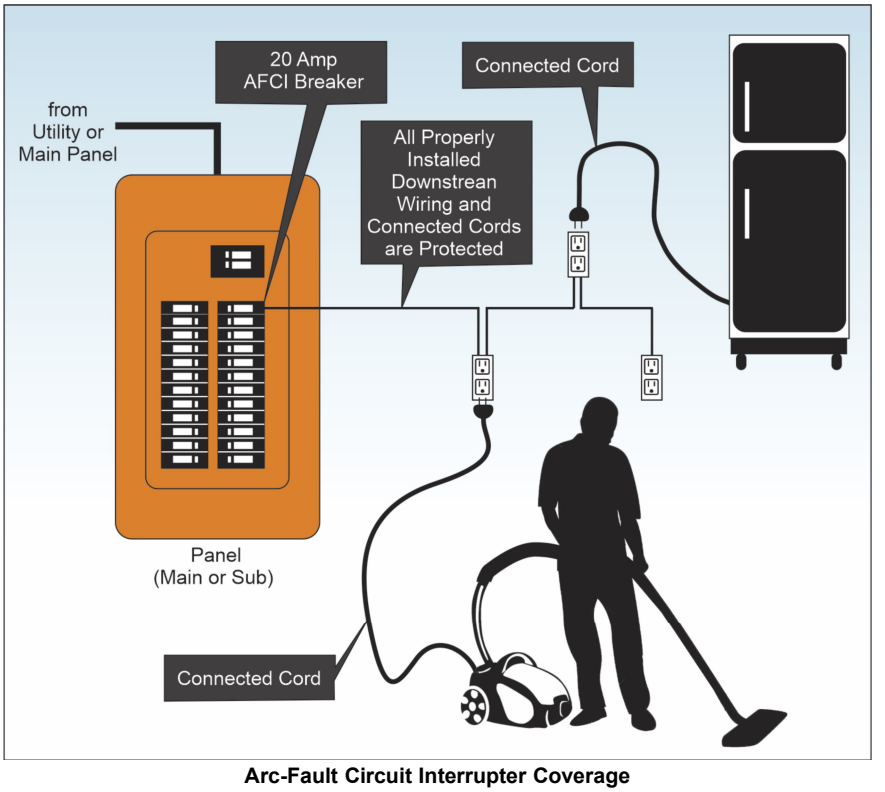
Advancing Electrical Safety

By: Arthur J. Smith, III, P.E.



Arc-Fault Circuit Interrupter Coverage

In 1996, more than 40,000 residential electrical fires, 300 deaths, 1,400 injuries and $680 million in property losses were attributed to residential electrical fires. Unlike other causes (smoking, cooking fires and arson), electrical fires are less likely to be reduced by educational programs. A "technological or engineering control solution" was needed to reduce residential electrical fires. Short-Circuits are detected and isolated by a home's circuit-breakers or fuses. Unfortunately, loose or poor connections, especially common in older homes, can create very high temperatures that cannot be detected by normal circuit-breakers or fuses. The reason is the power or heat developed is proportional to the current squared times the resistance. Since a loose or poor connection increases resistance, high temperatures can be developed with minimal currents well below the protective circuit breaker or fuse trip rating. If someone ever notices "blinking lights" or "warm plugs" connected to a receptacle, immediately turn-off or unplug the equipment and call an electrician to correct the problem. Older electrical receptacles can lose their spring tension creating poor connections when a plug is inserted creating a fire hazard. If you notice a plug goes easily into the receptacle or easily comes out, discontinue use immediately.

The 2002 revision of the NEC® required Arc Fault Circuit Interrupter (AFCI) protection in ALL bedroom circuits. The 2005 revision allowed AFCI protection to be "Combination Type" AFCI in bedroom circuits. Combination type AFCI protection incorporates BOTH arc fault detection as well as Ground Fault personnel type GFCI protection. In 2008, the NEC® expanded Combination Type AFCI to bedrooms, family rooms, living rooms, parlors, libraries, dens, sunrooms, recreation rooms, closets or similar rooms. The 2011 NEC® edition further expanded Combination Type AFCI protection to also include similar areas and hallways.

LEAKAGE CURRENT DETECTION AND INTERRUPTION (LCDI)

We have all seen window air conditioner plugs that resemble the Ground-fault circuit interrupter (GFCI) plugs described in the previous Consultant.

Section 440.65 of 2002 NEC required that room air conditioners incorporate AFCIs or LCDIs in their power cord or in

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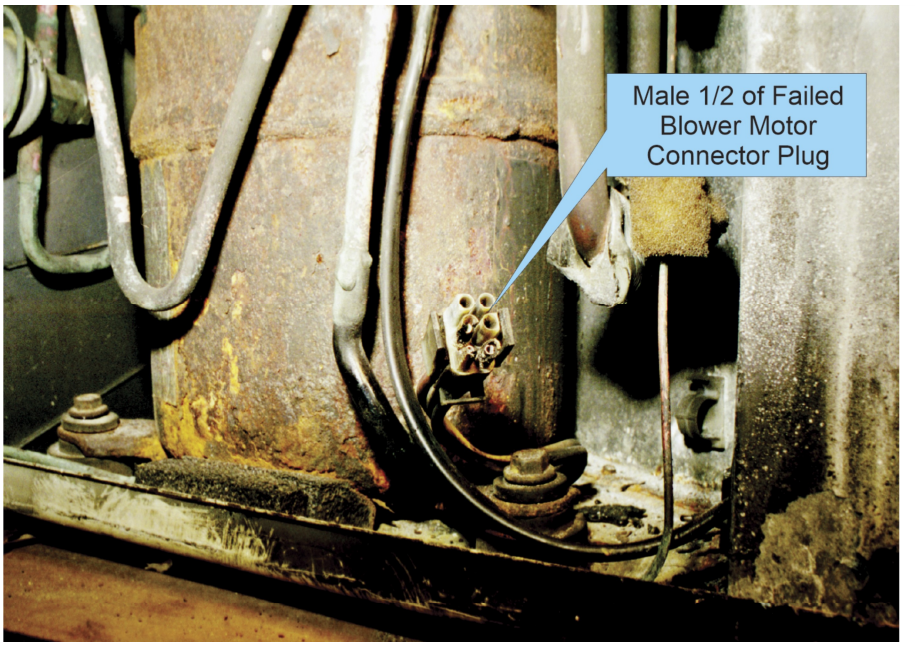
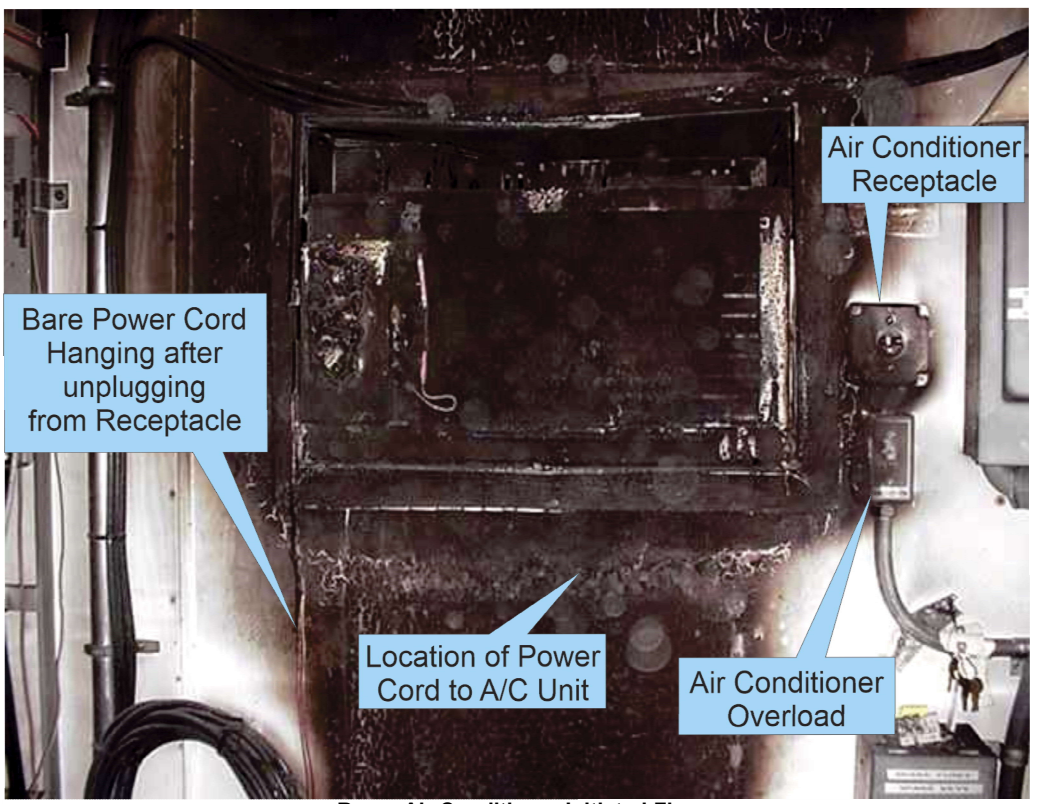
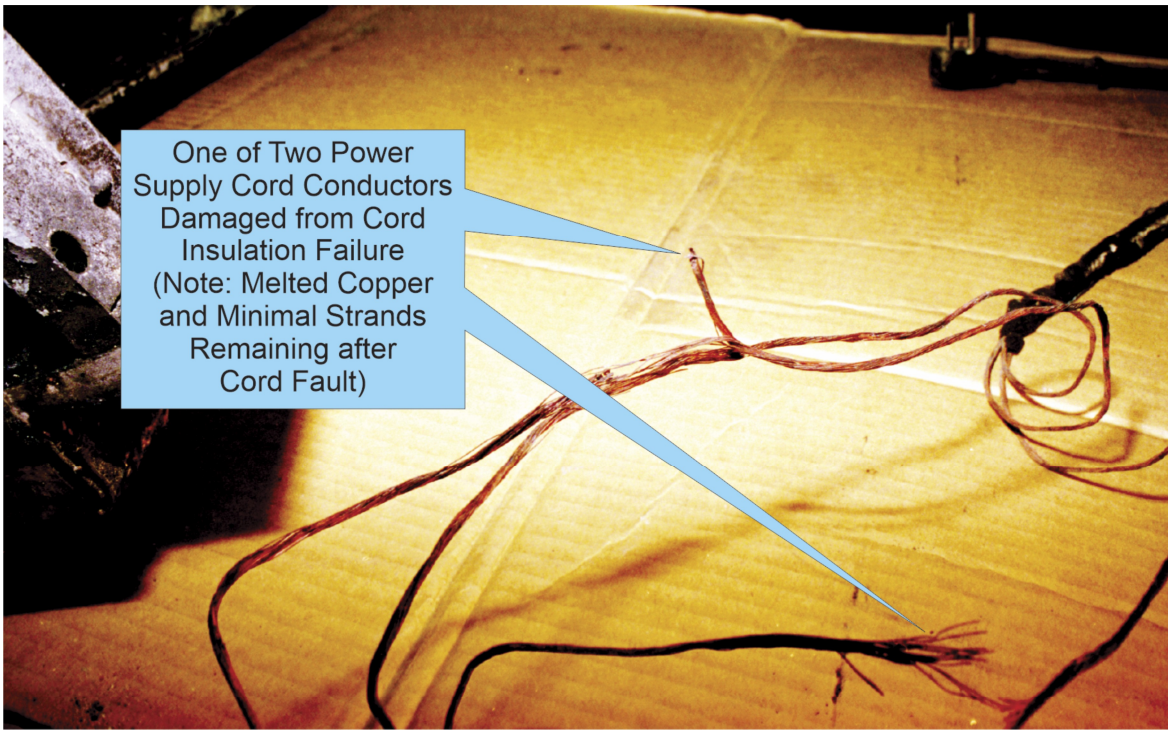


the A/C plug cap. However, in 2002 air conditioning manufacturers were still making air conditioners without these devices. This was one of several cases where the NEC included a requirement before the product safety standards (e.g. UL, FM, CSA, etc.) had been developed to support the new requirement. The concern was that window type room air conditioners had been identified as initiating fires even when properly installed per NEC requirements, leading to injuries and in some cases loss of life. Unfortunately, the product standards failed to address this issue as quickly as the NEC code making panel (CMP) desired. Placing Arc Fault Circuit Interrupter or Leakage Current Detection Interrupter (LCDI) requirements for room air-conditioners in the NEC would force Nationally Recognized Testing Laboratories (NRTLs) such as UL, FM and CSA to develop the product standard requirements. The NEC rule migrated into a product standard, and, in turn, initiated specific product requirements that were in league with the NEC rule. The decision to require LCDI on room air conditioners by the NEC (CMP) was aided by a NELSON Engineer serving on this CMP and his recent Root Cause Failure investigation experience of a room air-conditioner that initiated a fire in 1999. The problem was the circuit protection required to feed the room air conditioner (A/C) could not detect an internal short circuit fault within the A/C unit due to the small unprotected wires within the unit. When a short circuit occurs within the A/C unit, in some cases it appears as a load to the short circuit protection feeding the A/C, allowing the cord connecting the unit to a receptacle to melt and in some cases initiate a fire as seen in the photo.



Room Air Conditioner Initiated Fire

This fire was initiated by failure of a small internal connection feeding the A/C's blower motor. Unfortunately, due to the internal wire size restricting current flow, the resultant "short-circuit" was below the circuit breaker's trip rating as specified by the NEC and



appeared as a normal load to this protection. This allowed the A/C cord to overheat and initiate the fire, an all too often result of internal A/C electrical failures.

The short-circuit was eventually stopped when one of the A/C cord's bare copper conductors melted, as seen above, interrupting the fault.

A/C POWER CORD

Unfortunately, the bare conductors remained energized creating a shock hazard until the circuit breaker was manually turned-off.

The LCDI acts like a GFCI but also incorporates a metal sheath under the cord jacket. This grounded sheath detects cord failures before they become safety hazards. Once again, NELSON is helping advance electrical safety through our unique experience and participation in codes and standards development.

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STEM Education

Andy Morrison, P.E., Electrical Engineer, spoke to students from the Alief Independent School District and the Stafford Municipal School District at the Electric Technology Drives the Future, A STEM Education Event in Stafford, TX on April 17, 2019. He addressed why people would want to become an engineer, the importance of engineering, the main engineering disciplines, and what it takes to become an engineer.

2019 UNO Crawfish Mambo NELSON Boiling Teams


"Farm Animals"

"Under Construction"


"Ebullition Maitres"

Congratulations to team **"Farm Animals"** for winning the Best Decorated Booth. Team members were Luan Van Tran, Justin Bertheaud, Natalia & Gabriel Varona, Corey Peltier, Nathan Linhardt and Martin Patterson. Team **"Ebullition Maitres (Boiling Masters)** was Jonathan Sochia, Raymond Herkes, Christopher Comeaux and Felicia Adams. Team **"Under Construction"** was Anthony Beard, Michelle Jones, Tonya Coleman. Nick Maalouli, Yorgos Gaitantzis, Courtney Mai, Orin Dodge and Rhett Briggs.

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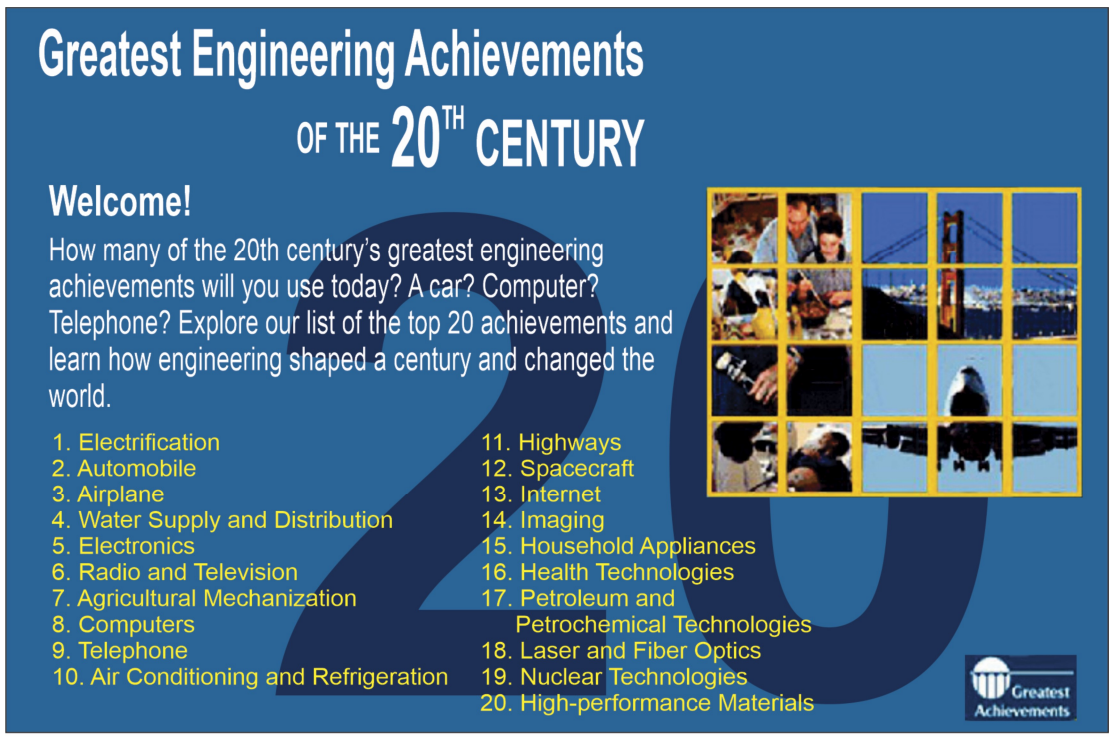

In celebration of the 21st century, the National Academy of Engineering engaged 29 professional engineering societies to nominate and rank the most significant engineering achievements of the 20th century. The NAE notes that the top achievement, electrification, powers almost every pursuit and enterprise in modern society. Advancements in the other 19 achievements on this list were dependent on electrical technologies.