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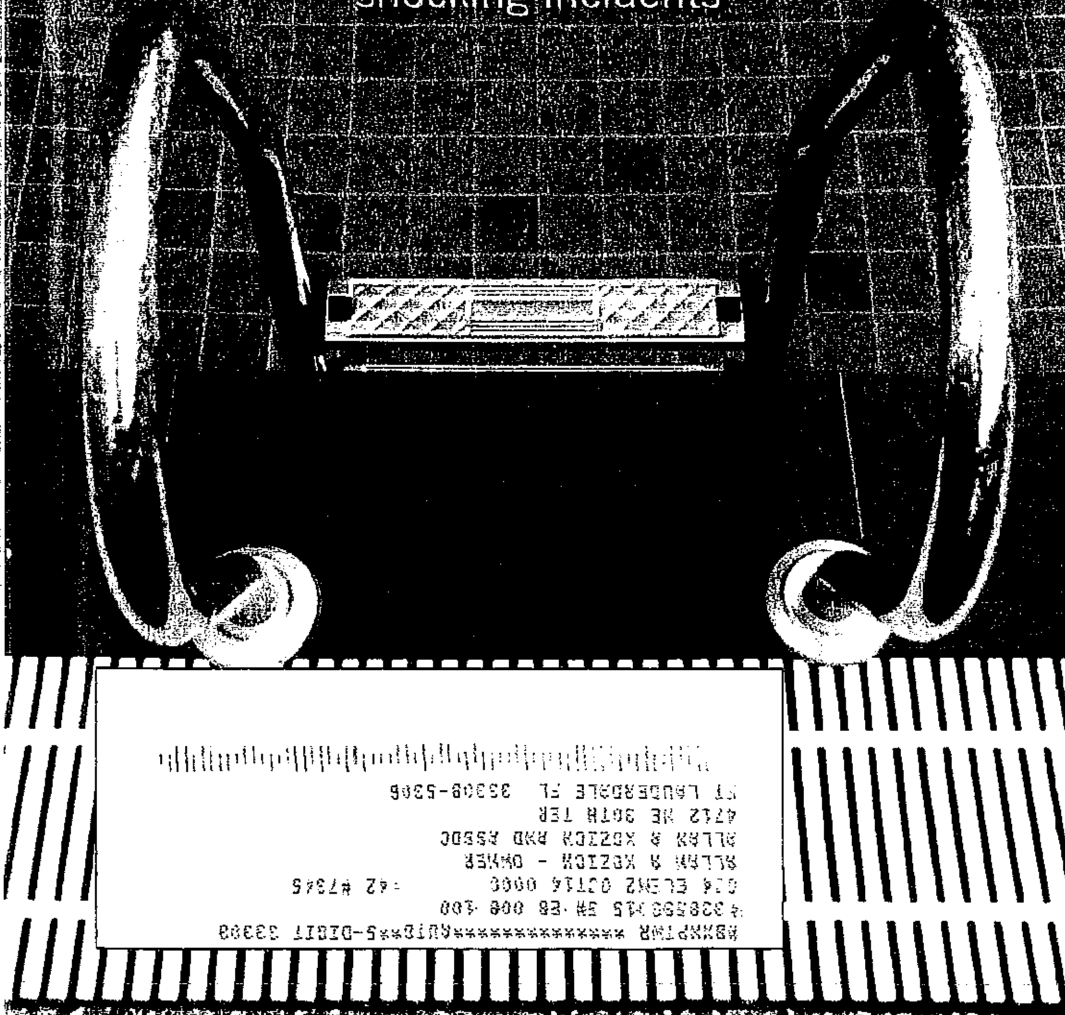
OCTOBER 2014

EC&M

THE MAGAZINE OF ELECTRICAL DESIGN, CONSTRUCTION & MAINTENANCE

POOL SHOCK PERIL RESURFACES

Push for low-voltage lighting and more careful inspection/maintenance follows electrocutions, shocking incidents



ALLAN A KOZICH - OWNER
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CODE BASICS

Switch play: Revised rules for connecting branch circuit devices

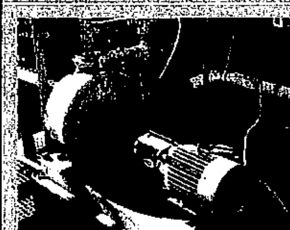
ILLUSTRATED CATASTROPHES

Out of bounds: This mini-golf installation deserves more than a single-stroke penalty

CODE QUANDARIES

One for all? The answer depends on the path taken

FORENSICS



Black and white: Improper motor connections prove it's not always this simple

WHAT'S WRONG HERE?

Public exposure: This installation should be ruled a crime

EC&M TALK

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A PENTON PUBLICATION

Shock Hazards in the Water — Part 2

By Michael Eby,

I recently shared my thoughts with you on the danger of electric shock in bodies of water in our August 2014 issue. Although I briefly touched on the topic of swimming pools in this earlier editorial, my main focus was really on ponds and lakes where docks and marinas are located. After discussing the danger electricity poses at these locations and reviewing the terrifying issue of electric shock drowning, we now turn our attention to electric shock hazards in and around swimming pools.

These three headlines all appeared within the last three months.

- "Pool Repairman Dies in Suspected Electrocution in Florida" — a pool repairman died while working on a pool light at a private residence in Panama City Beach, Fla.
- "Pennsylvania Town Closes Pool After Shocks Reported" — a town shut down its pool after a patron reported feeling electrical currents while sitting on the pool deck.
- "Children Shocked in Public Pool in Philadelphia" — a city shuts down public pool after three children were shocked. Area residents said children had complained for the past month or so of tingling or "pins and needles" sensation when swimming.

We reported on these events via news posts on our website. Although they're a small sample size of what's taking place around the country, they do reinforce the need for proper design and construction techniques, enhanced maintenance and testing procedures, and widespread training on the proper bonding and grounding techniques for swimming pools. For those of you performing electrical work on swimming pools at any type of facility, these types of stories help drive home the importance of your work.

Article 680 of the NEC covers effective bonding and grounding requirements, the use of GFCIs, and proper installation of luminaires and receptacles in close proximity to or directly associated with the pool. Protection techniques include the use of GFCI devices, double-insulated equipment, equipotential bonding grids, and insulation and isolation techniques. Anyone involved in the design or construction of pools should be intimately familiar with the latest requirements set forth in this 2014 edition of the NEC.

Although all of these requirements are critical to a successful installation, the spotlight of late seems to be focused on lighting systems. With the proliferation of LEDs in the market, debates are now taking place with regard to the pros and cons of traditional incandescent-based luminaires (120V systems) vs. LED or even fiber-optic low-voltage type units. Codes and standards, as well as education initiatives among the installation and inspection community, are struggling to keep pace with the introduction of these new technologies. The concern is that new rules and regulations get adopted that lock designers/installers into using a specific technology, which ultimately may or may not prove to be as safe. A more detailed review of these factors and several others are outlined in this month's cover story, written by Tom Zind, "Pool Shock Peril Resurfaces," starting on page 18.

Just as I noted in my August editorial, maintenance and testing of these protective systems is a crucial component for the everyday safety of swimmers. Corrosion and deteriorated bonding and grounding connections often expose swimmers to shock and electrocution hazards. Many times, these faulty connections can be traced back to the use and installation of non-listed connectors and poor workmanship, which ultimately lead to a breakdown in the overall protective system.

Michael Eby

The Case of the Improperly Terminated Motor

What led a qualified electrician with more than 20 years of experience to make incorrect motor connections?

By David A. Pace, P.E., Olin Corp.

For most electrical professionals working in an industrial or manufacturing setting, motor replacement is considered routine maintenance work. This case, which involved a 25-hp, 460V 3-phase motor that had been in service for several years but needed to be replaced due to failed bearings, appeared to be no different than other motors the in-house electrical staff had worked on in this particular industrial facility. But after replacing the motor, the pump still wasn't operating properly — it continued to trip repeatedly on overcurrent upon startup. As a result, in-house maintenance mechanics were called in to troubleshoot the situation and get to the root of the problem. *Note:* At this facility, certain employees perform electrical work (wiring, electrical hook-up of motors, transformers, etc.) and others handle mechanical work (installing and aligning motors, piping, welding, etc.)

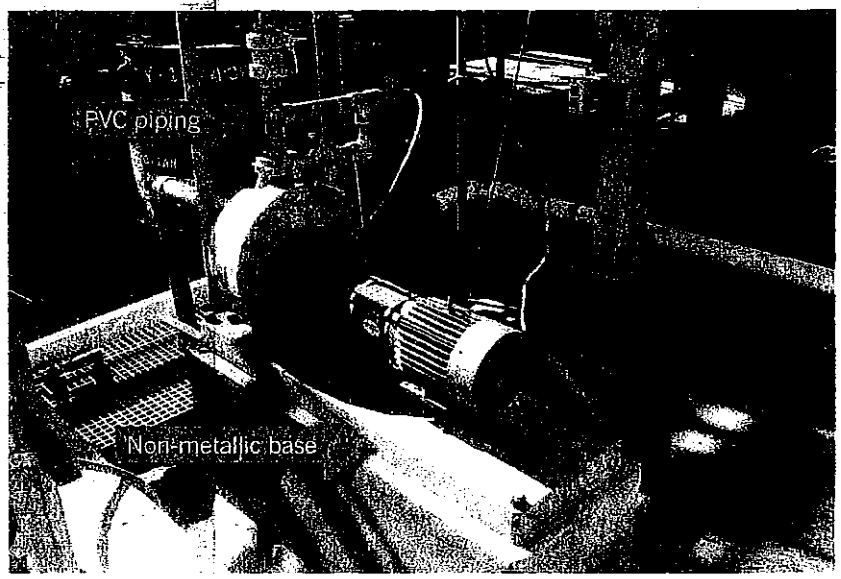

Photo 1. The pump/motor assembly mounted on a non-metallic base and connected to the process through non-metallic piping operated in a hydrochloric acid service environment.

The scene. One electrician simply isolated and disconnected the failed motor from the electrical supply so that the maintenance mechanics could remove it, install a replacement motor, and correctly align it to the pump. Another electrician reconnected it. Both men were in-house electricians with several years of experience that took their work very seriously, were considered competent, and always maintained a clear focus on safety.

Because the pump was operating in hydrochloric acid service, the pump and motor base, the piping, and all surrounding support were made from non-metallic materials to prevent corrosion. The site, of course, required grounding conductors to all motors, the ground conductor was run with the phase conductors, and was connected to the grounding connection in the motor terminal box, as required by company specifications and applicable codes and standards. At the time, the site did not require an additional external equipment grounding conductor, which would have been run external to the conduit/tray/channel that contained the phase supply conductors and grounding conductors, for motors below 200 hp. The motor frame had no external connection to ground either through a separate conductor, piping, or the motor frame. *Note:* Company policy now requires an additional external grounding conductor to be connected to the motor frame in cases where the motor/pump base is made of non-metallic materials.

The accident. While troubleshooting the small acid pump, the maintenance mechanic started the motor while leaving his hand on the pump housing, which was connected to the motor frame. Immediately suffering a serious electric shock, the victim received current flow from one hand through his upper body to his feet or legs (it was not clear which). Although he reported experiencing severe pain and discomfort from the shock, the victim exhibited no external signs of injury. However, he was

still taken to an on-site medical facility, where he was evaluated and kept for the rest of the shift for observation. Fortunately, no injury or subsequent complications resulted from this accident. In retrospect, it was determined that the level of current was likely limited because the victim was wearing rubber boots (not for shock protection but for protection from injury due to the chemical burn risk in the area).

Following the incident, many questions remained. At the top of everyone's mind was what had caused an electrician with more than 20 years of experience — considered a responsible, proficient, and "qualified person" — to obviously make an incorrect motor connection?

Investigation and analysis. The author, who served as the Instrument & Electrical (I&E) superintendent in the maintenance department was called in to investigate from a reliability angle as well

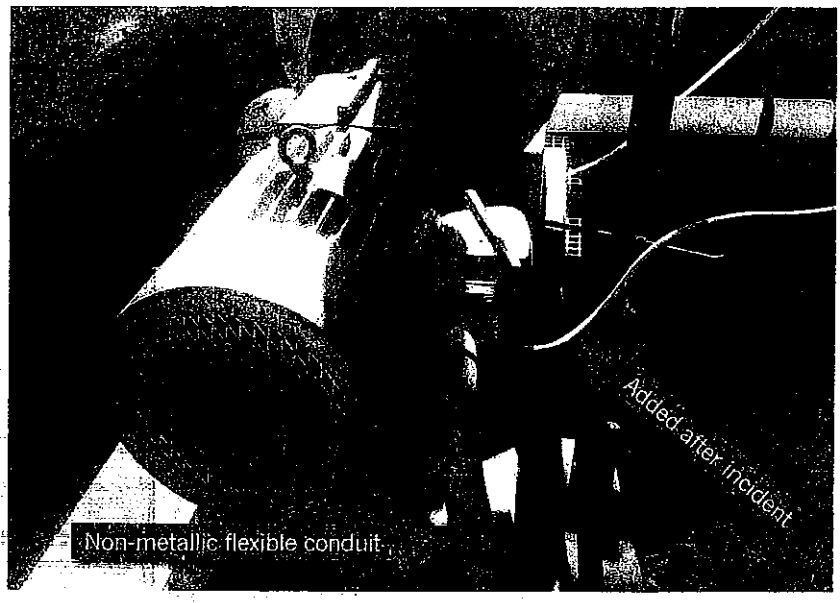

Photo 2. The conduit, containing the phase and grounding conductors, was non-metallic as well. *Note:* The additional, external grounding conductor shown was added after the incident.

as a safety standpoint. He was not only the leader of electrical safety initiatives at the facility (responsible for establishing electrical safety policies and procedures), but he also oversaw the development and implementation of such requirements in safety policies and procedures. The initial investigation uncovered several facts.

The motor feeder had three color-coded phase conductors: black, red and blue, and one green insulated equipment grounding conductor. A grounding lug was provided inside the motor terminal box. The motor had been connected incorrectly with the blue conductor connected to the grounding lug and the green conductor connected to one of the motor leads. This, combined with the fact that the unit was basically insulated from ground, caused the motor to single phase. Why didn't someone notice this problem prior to the accident? Similar symptoms would have been present if the pump had been plugged or had restricted flow — and since the motor had just been changed — the staff felt like the problem was with the pump.

Although the installation had been in service for some time and the feeder conductor colors had faded somewhat, they were still clearly identifiable. During the follow-up investigation, an interesting

Quantifying "Qualified" Persons

Factors that determine whether or not a person is "qualified" include education, experience, training, and knowledge. The definition of a qualified person is one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

Other factors also affect whether or not a person can be considered "qualified" in the traditional way of thinking, including physical limitations, emotional issues, medical issues, and personal issues. Because employees or potential employees are often reluctant to discuss personal issues, the possibility (as in this case) could exist for an otherwise qualified person to actually be unqualified to do the work. Therefore, it's important to assess individuals for various factors that could affect their status as a qualified person.

Sources: NFPA 70E and the National Electrical Code

development was uncovered. After being called to the accident site for additional clarification on what had happened that day, the electrician that reconnected the motor stated that the motor connections were correct — with the green colored conductor connected to the grounding lug. This shed light on the underlying problem, given the fact that the blue conductor was connected to the grounding lug. After this was pointed out to him, the victim admitted he was color blind and had difficulty identifying phase conductors by color alone. Instead, he relied on numbers, letters, or some other identification method (coworkers) for clarification.

Lessons learned. In corrosive environments, it's next to impossible to find materials that are resistant to deterioration; therefore, non-metallic materials are typically used. Due to this fact, an additional external grounding conductor should be provided.

After the accident, electrical specifications were reviewed to be sure all similar existing and future installations included an external grounding conductor in addition to the one connected to the motor frame inside the motor terminal box. Adjustments were made and communicated to other plant sites within the company. Special emphasis meetings were also held with electrical and mechanical craftsmen to ensure the technical aspects of the incident were well understood. Lockout/tagout procedures include verification of proper voltage and current on all phase conductors once the motor is put back in service. The details of this incident, and proper procedures when non-conductive materials are used, are included in the company's electrical safety training. The facility now also requires a color identification test as part of physical exams both for new hires and for routine, periodic exams of existing employees.

Although this incident wasn't complicated and no legal action was taken, it did have a serious potential for injury or death. This case demonstrates how important it is for a company to create an environment in which employees feel comfortable discussing personal issues that pertain to their ability to do their jobs efficiently and safely. Individuals who possess limitations that could affect their status as a "qualified" worker (see **Quantifying Qualified Persons** on page 14) have a responsibility to discuss them with the appropriate people within the organization. Similarly, those in management positions who evaluate qualifications and assign jobs also have the same responsibility for proper consideration of such issues. **EC&M**

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By Tom Zind, Freelance Writer

POOL SHOCK PERIL RESURFACES

A stew of knotty issues is sparking fresh debate over whether swimming pools adequately protect users from the menace of electric shock. Leading the way is a flurry of publicity about deadly and injurious encounters with stray electricity around the structures, rekindling a fear that seems to bubble to the surface with clocklike regularity.

Aging pools — and the risks they carry in the form of degraded or outdated infrastructures — compound those concerns. Add in lingering questions about the qualifications of installers and inspectors, calls for tighter regulations/new safety standards, and the rise of new technologies, and it's clear that pool electrical issues are getting more attention.

The core concern is whether more pool structures (existing and newly built) are slipping into the danger zone. The adequacy, functionality, and reliability of essential protections against the risks posed by an environment where water and electrical current must coexist in close proximity — chiefly equipotential bonding and grounding systems — are coming under increasing scrutiny.

Tragedy strikes again. Those persistent concerns were stoked this summer by the electrocution of a 7-year-old Florida boy, which followed an incident last summer that saw a man electrocuted in a Houston hotel pool.

According to news reports, the boy, Calder Sloan, was swimming in the pool at the family's Miami home when he was thrown from the pool and knocked unconscious. Investigators believe the pool water became electrically charged when current entered through a light fixture in the in-ground pool. They reportedly discovered that a ground wire wasn't attached to the transformer, opening the way for 120V to energize the light casing, allowing electricity into the pool water.

The boy's death spawned a wrongful death lawsuit that names, among others, a Miami electrical contractor reportedly hired soon before the incident to perform electrical maintenance on the pool. Brought by Colson Hicks Eidson, Coral Gables, Fla., the suit alleges Gary B Electric & Construction failed to "use reasonable care in the inspection, installation, and repair of the home's electrical components, including the installation of the new electrical panels and the pool pump's grounding rod and removal of the pool deck's pole light, to ensure the electrical system was properly grounded and bonded."

Photo 1. This aerial photo shows a pool being rebuilt and brought up to current Code requirements. The equipotential bonding ring for the perimeter surface is located in the trenches encircling the pool. This ring is installed in the subgrade under the perimeter deck surface (in this case, pavers).

Electricians also were implicated in the Houston incident, in which a 27-year-old man was electrocuted while coming to the aid of a child who was struggling in water that had been delivering shocks to other swimmers moments before. According to media reports, two employees of Brown Electric, Inc., a Houston-area contractor that had been hired by the hotel to perform pool bonding and wiring work were charged with criminally negligent homicide after an investigation found that wiring to the pool light lacked a GFCI device, setting up conditions for current to flow into the pool water. It's also alleged that the company did not secure a permit to perform the work.

Searching for answers. While the root causes of both electrocutions may prove to be different — and remain to be clarified within a legal framework — the incidents appear similar in one respect: They point to a likely blend of negligence, incompetence, and ignorance — a potentially lethal combination when working with a pool's electrical infrastructure. In a larger sense, the

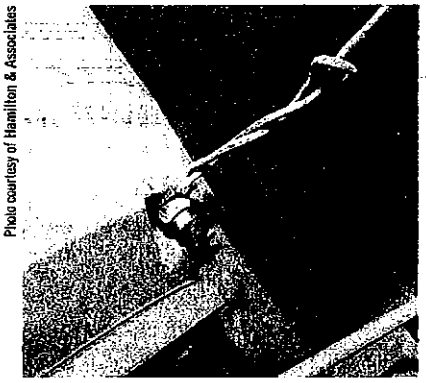

Photo courtesy of Hamilton & Associates

Photo 2. This image shows an improper attachment of a bonding wire to a pump motor at a large competition pool. The bonding wire should be installed with a suitable connector.

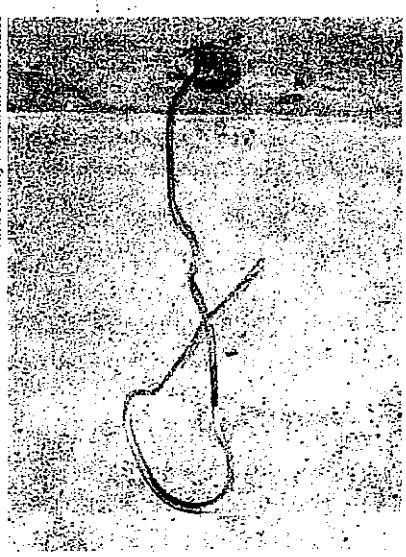

Photo courtesy of Hamilton & Associates

Photo 3. This bonding wire from an underwater pool light (seen from the back side of the pool structure) is not connected to the equipotential bonding grid.

electrocutions serve as a reminder of what's at stake when pools are designed, installed, and maintained — not to mention the need for safe components, competent personnel, and routine maintenance.

That message has seemingly been heard in Florida. The governing body of the county in which the 7-year-old boy died has been moving ahead with controversial legislation addressing one aspect of that tragedy.

The Miami-Dade Commission gave its early backing to a law that would require any lighting installed in and around newly installed or improved private swimming pools to be of the low-voltage/transformer variety, extending the scope of a requirement that exists for commercial pools in the county. Even though the Sloan pool apparently had such lighting — and the accident appears tied to human error and faulty wiring of the system that uses a transformer to step down 120V to a fraction of that to power lights — the incident reignited a long-simmering debate in the state over pool safety requirements and what can/should be done from a public policy perspective.

Low-Voltage Lighting Steps into the Limelight

In addition to traditional low-voltage incandescent lighting, new and improved lighting technologies are becoming acceptable options. Lighting, in turn, is poised to become safer and more functional, versatile, and dynamic.

"Because of changes in technology, consumers have more lighting choices than ever," says Carvin DiGiovanni, senior director, technical and standards, for the Association of Pool & Spa Professionals. "Options include LED, fiber optics, as well as different incandescent lighting."

While traditional 120V lighting is still the dominant and preferred type — both for its cost and performance — low-voltage is catching on because it's delivering a package of new solutions. New UL-listed products are coming to market that conform to low-voltage lighting standards in the NEC, and many don't require grounding because they're sealed in plastic.

"There's a lot of amazing, all solid-state stuff being manufactured now that would never have been allowed at 120V," says Bill Hamilton, III, a pool electrical expert and president of Hamilton Associates. "Some of it is microprocessor driven, allowing you to put on a real light show."

But new generations of safer and more functional lighting also incorporate new technologies that aren't yet fully understood in the field. Although the Code has evolved to address low-voltage, some low-voltage installations lie outside traditional interpretations.

"Some of this new high-tech lighting can have some very sophisticated power supplies," Hamilton says. "That was recognized in the 2011 Code cycle, and we're still working with authorities having jurisdiction to get them to bring local ordinances regulating low-voltage lighting into line with some of these new technologies.

"We don't want them red-tagging installations that would actually be desirable in terms of low-voltage alternatives. If you say you're not going to allow anything but a 15VAC light or below, you may be excluding a whole category of brand new solutions that may be very desirable and could be a lot safer."

The transition to these new technologies is being aided by new ways of defining acceptable pool lighting. Hamilton notes new pool and spa industry code language that sets a clearer, more objective standard for determining minimum pool illumination requirements. Along with an industry push to use a lumens rather than a wattage standard to categorize lighting and better guide how lighting is best deployed, the effort could further set the stage for the deployment of more low-voltage lighting in pools.

"Technology, because of a number of factors, is tending to move in a direction that's going to provide inherently safer devices just because they're getting away from 120V and getting into fairly low-voltage, reasonably low-current solutions, compared to incandescent lights," he says.

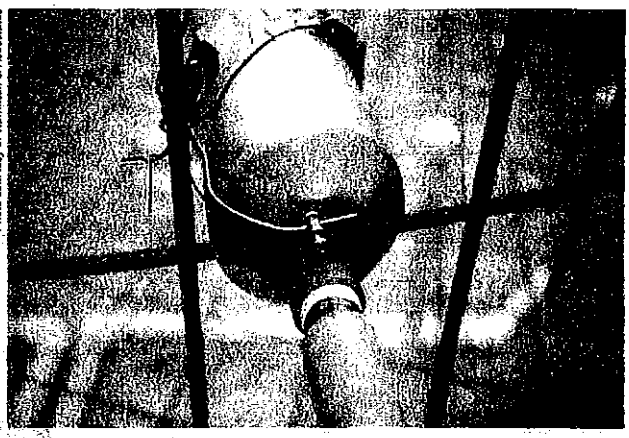

Photo courtesy of Hamilton & Associates

Photo 4. Proper installation of a bonding conductor from the back of a metallic light niche to a listed clamp (not in photograph) attached to the pool structural steel. Because the conduit is non-metallic, a second No. 8 AWG wire must be run from the lug on the interior of the niche to the ground bus in the junction box, power supply, or transformer enclosure serving the light; the connection inside the niche must be potted with a suitable listed potting material.

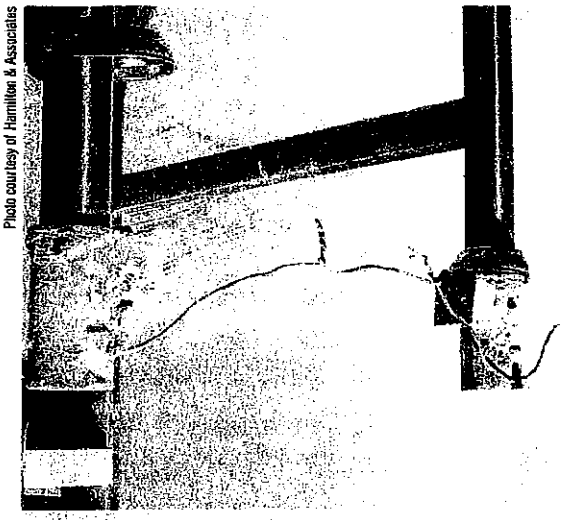

Photo courtesy of Hamilton & Associates

Photo 5. Pool ladder pockets must be bonded, but not this way. There is no assurance of electrical continuity because of the twisted connections. This was discovered upon excavation and illustrates the need for vigilance and frequent observations during the construction process.

A tireless advocate of stronger regulations on pool lighting, Irv Chazen, owner of Custom Pools, a Miami pool installer, and an official with Associated Swimming Pool Industries of Florida, applauded the commission's action, saying the boy's death should offer an unequivocal answer to the question of "why have two standards; why not carry the same mandatory requirement to install low-voltage lighting and transformers to family pools?"

Caution urged. But other pool installer interests greeted the push for new regulation, which had expanded in August to Palm Beach County, Fla., with calls for caution. In light of the electrocution tragedies, The Association of Pool & Spa Professionals (APSP) instead emphasized the need for more vigilance in inspecting and maintaining pools, stopping short of endorsing any kind of blanket requirement for low-voltage lighting.

Carvin DiGiovanni, the association's senior director, technical and standards, says the incidents point to a clear need for pool owners to better monitor and inspect aging pools and to ensure that maintenance is performed by competent professionals. However, he worries that more stringent lighting requirements, while appealing when framed as "low-voltage" solutions, could end up stifling the search for new solutions at a time of surging innovations

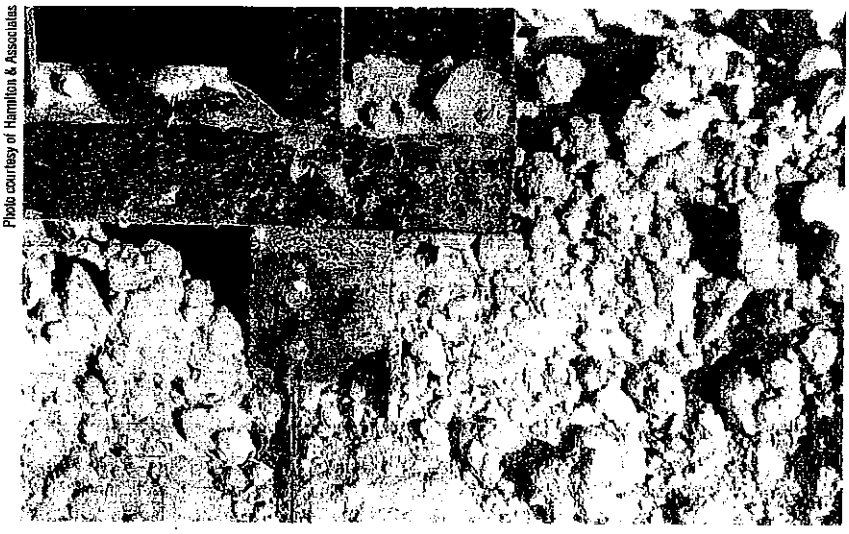

Photo courtesy of Hamilton & Associates

Photo 6. All metallic fences within 5 ft of the inside wall of the pool must be connected to the equipotential bonding grid. In making these and other connections subject to direct burial, listed devices suitable for direct burial must be used, and it is important that attachment screws be stainless-steel or other corrosion-resistant material.

Photo courtesy of Hamilton & Associates

Photo 7. This photo shows an improper connection of the bonding ring to the pool's structural steel. Plated steel screws, even in listed devices, generally will not last in a corrosive pool environment.

in new pool lighting delivering better safety, performance, and aesthetics.

"I think we need to be careful that we don't lock into something on low-voltage that could minimize the chances for new lighting technologies that may require higher voltage, augmented with different processes that lead to safer lighting," says DiGiovanni. "There's still a school of thought that questions whether low-voltage will solve the safety problems."

But low-voltage lighting in and around pools is growing more popular, a trend progressively reflected in the National Electrical Code (NEC). The 2011 NEC established a "low-voltage contact limit," an acknowledgement of the surging popularity of pool lighting and the need to spell out safety parameters, product specifications and installation and configuration guidelines for emerging low-voltage alternatives. Restrictions on such lighting are relaxed in the 2014 NEC; low-voltage luminaires that don't require grounding no longer have to be placed a minimum of 5 feet from a pool's inside walls.

Beyond lighting. Even as forms of potentially safer lighting emerge, many aging pools remain tied to 120V lighting systems that themselves are aging, often in concert with GFCI protection and pool bonding systems essential to pool electrical safety.

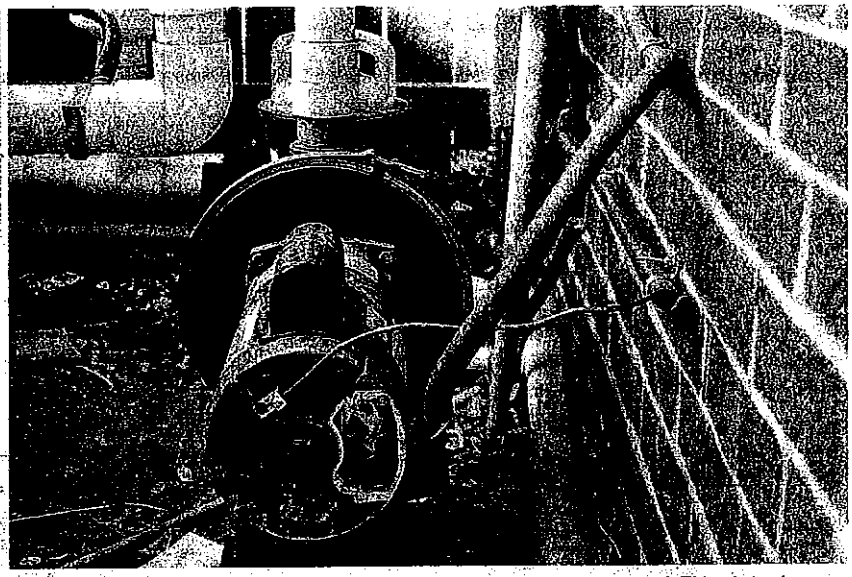

Photo courtesy of Hamilton & Associates

Photo 8. The bonding system extends back from the pool to the equipment pad. This photo shows a proper bonding connection at the pump motor, prior to the wiring compartment cover being installed.

The condition and operability of those systems, according to Code experts and electrical contractors who install and maintain pools, is the real concern when it comes to pool safety. If compromised, that can neutralize any margin of safety offered by low-voltage lighting.

Underwater lighting systems do pose a clear threat because corroded and faulty fixtures can become electrodes for introducing current into water, says pool electrical systems expert Bill Hamilton, III, president of Hamilton Associates, a Pflugerville, Texas engineering services firm. But the root cause of most shocking incidents, says the member of NEC Code-Making Panel No. 17 (CMP 17) representing APSP that oversees Art. 680 covering pool structures, often lies with systems that are supposed to form a barrier to electric current ever posing a lethal threat.

"Almost inevitably," he says, incidents

he's investigated where shocks have been traceable to light fixtures "involve non-existent, faulty, or deteriorated grounding and bonding systems in concert with that."

Through the years, the Code has been revised to better define the proper design of pool equipotential bonding and grounding systems, which must remain operational over the course of many years. Following and maintaining those guidelines is essential, Hamilton says, both in the installation of new pools and the ongoing servicing required of pools as they age. Most critical is the equipotential bonding grid, consisting of copper-wire connections to metal components in and around the pool, which equalizes voltage and lowers the risk of electric shock.

CMP 17 addressed bonding again in the 2014 Edition of the Code. Concerned that wording referencing the "bonding of pool water," was confusing, the panel revised

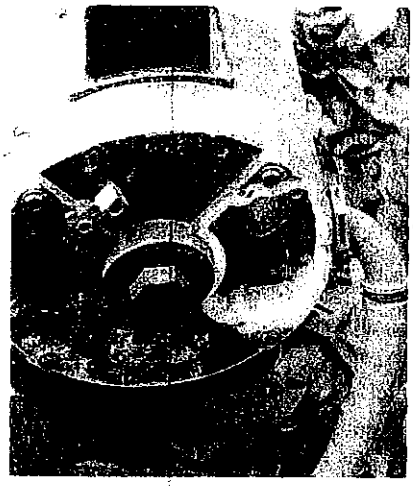

Photo courtesy of Hamilton & Associates

Photo 9. This image shows a pool pump motor prior to attachment of the bonding conductor to the lug at the upper left. The wiring compartment cover is open and also must be installed to provide a safe and Code-compliant installation.

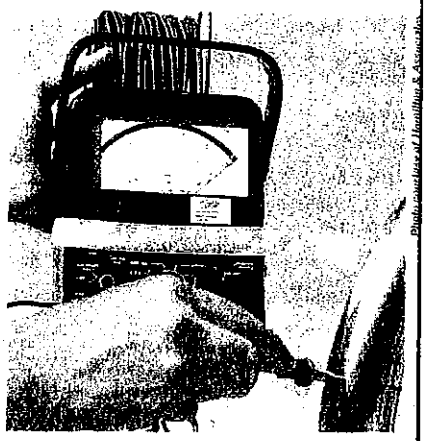

Photo courtesy of Hamilton & Associates

Photo 10. To verify the integrity of the bonding system, test it. Some states require periodic testing for commercial pools. This is basically a continuity test among items required to be bonded by the Code, and should be done so that the current being injected flows through the pool structural steel (concrete pools) and the perimeter bonding ring (non-conducting pools) such as fiberglass and vinyl liner pools. Plus, there are some things that old technology still does better, and this is one of them. Analog meters with large (C or D cell) batteries, an integral polarity reversal switch, and a "zero ohms" function allow the user to verify bond integrity over long distances and to detect if DC ground currents are affecting the measurement. More than 20 years of testing indicates that properly bonded equipment will exhibit resistances generally well less than 1 ohm, while ineffective bonds will measure substantially greater than 1 ohm. Equipment with current calibration (white label in the photo) should be used for these measurements.

Sec. 680.26. It now states that "pool water must have an electrical connection" to specific bonded parts, or "the water must be in contact with a corrosion-resistant surface that's at least 9-square inches." A new requirement to ensure functionality is that the item making contact with the water must be "in an area where it won't be dislodged or damaged... ."

Knowledge and competence gap? Despite efforts to make pool bonding and other key elements of pool electrical systems more understandable, some see stubborn confusion about how it's actually done. That's putting not only newly installed pools at risk, but also older pools whose bonding

grids can deteriorate over time and may require refurbishing or repairing. As the recent shocking and electrocution incidents suggest, there's no certainty that every pool installer or the electrical contractors they typically sub work out to fully understand the nuances of pool bonding or grounding — or that they can be trusted to perform the work by the book.

In his years as an electrical and building code enforcement officer for the town of Ithaca, N.Y., Chas Bruner has witnessed a less-than-ideal grasp of the bonding concept, in particular. That's compounded by installers who sometimes choose not to hire electrical specialists to do the work, a byproduct of comparatively loose state regulations on employing licensed electricians.

"Some people aren't trained, and, in a lot of cases, you have college kids doing the installations," he says. "So you end up counting on seeing some pretty flimsy bonds and since there can be a lot of different pool designs, it can be hard to see if they've selected the right way of doing it."

Install jobs can be difficult to thoroughly inspect as well, he says, because the perimeter bonding is quickly covered with concrete in fast-paced jobs. "You have to get there quickly," he says. "I've had concrete trucks ready to pour, waiting for me to give the OK. In some cases, I've had to hold them up."

Time takes its toll. Even if they're installed properly — and that's hardly guaranteed if work is governed by outdated versions of the NEC — pool bonding and grounding systems are subject to wear and tear. Over time, these systems can and do corrode, and a host of variables can affect the pace of decline. That fact heightens the importance of, as the pool group APSP advises, "inspection, detection and correction" to address things like "aging electrical wiring, the use of sump pumps and vacuums that are not grounded and lack of proper bonding."

Triec Electrical Services, Springfield, Ohio, has heeded that call. Motivated partly by news of pool electrocutions, Owner Scott Yeazell says he's recently begun offering complimentary inspection and testing of pool bonding. He suspects there are enough degraded systems in existence that repair work will provide the payback. He's eager to step in because he knows vigilance can be the difference between life and death.

"Bonding is your secure backup. If it's gone and you don't know it, you're at risk," he says. "But I don't see any program or commonly accepted practice of testing bonding to see if it's intact or not."

Hamilton, who senses that bonding still "mystifies" many pool owners and electrical

In the News and on the Web

EC&M has reported on several stories recently that relate to the hazards electricity presents in pool applications. Read these and other full news reports at ecmweb.com.

Pool Repairman Dies in Suspected Electrocution in Florida

This worker died from a suspected electrocution in Panama City Beach, Fla., when he and another coworker were repairing pool lights at a private residence. According to a report from the *News Herald*, one man was working at the breaker box while the other was in the pool when the accident occurred.

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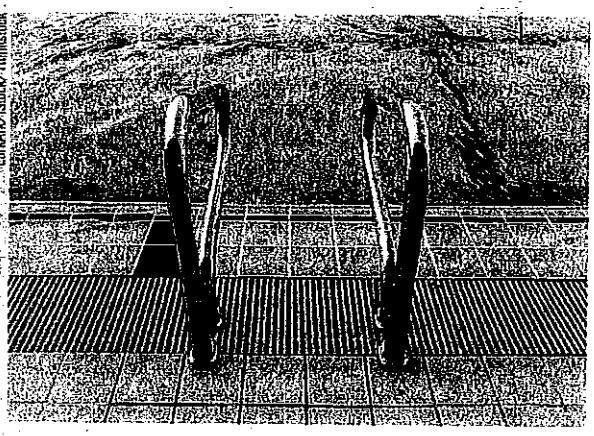

EdnaRH/iStock/Thinkstock

Pennsylvania Town Closes Pool After Shocks Reported

A town in Pennsylvania shut down its pool when a patron reported feeling electrical currents while sitting on the pool deck. The town council subsequently authorized $75,000 in emergency repairs after the incident. According to a report from *Lehigh Valley Live*, electrical engineers said the pool deck was improperly bonded.

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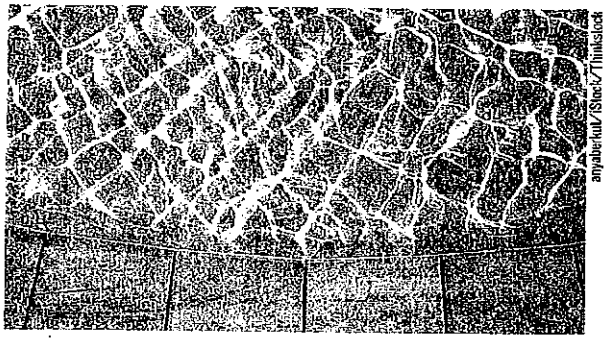

anyaberkut/iStock/Thinkstock

Children Shocked in Public Pool in Philadelphia

After three children were shocked in a public swimming pool in Philadelphia, local news sources said that area residents had been reporting for the past month a sensation of tingling or "pins and needles" when swimming. The pool was closed indefinitely, and the Philadelphia fire executive chief said an equipment malfunction could have caused the current.

http://bit.ly/1rtlkNc

Three Children Shocked at Florida Condo Pool

Three children were shocked at Florida condominium community pool as a result of shoddy electrical work. The children spent several nights in the hospital after being shocked at the Palm West Condo pool in Hialeah. According to a report on *Local10.com*, a green ground wire on the pool pump was disconnected. The building inspectors' report said that when the pump malfunctioned, the electricity wasn't directed into the ground. Instead, it energized the water the pump was pushing back into the pool. To see police photos, visit http://bit.ly/1rlBZSJ.

http://bit.ly/QERPZ7

contractors, says he's been an advocate of making inspections of both bonding and grounding systems a requirement. He has helped pioneer techniques and protocols to test systems, some of which have been referenced in a handful of states that have instituted mandatory commercial pool testing.

Right the first time. While maintenance and testing is important, Hamilton says safety starts with the initial installation. Installers must adhere to the up-to-date Code, he says, which should be incorporated into local ordinances. But bonding system design should be flexible to a degree, adapted to geographic variables like the water table and soil type, which can affect their functionality, and longevity.

"Pools are only as safe as they get built," he says. "But then they need to be maintained, and today there are a lot of 50-year-old pools out there."

While the recent focus on pool lighting is well justified, it's important to remember, he adds, that the pool electrical safety issue is multi-faceted.

"If you make a statement that says were going to have safe pools if we convert everything to 12V lights, that's a highly oversimplified statement that doesn't reflect the physics of what goes on with electricity in a pool," he says. "If it were as simple as that, then (NEC) Art. 680 (covering pools) would be one sentence: 'Put a 12V light in your pool. Thank you.'" **EC&M**

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