AN ANNEX PUBLISHING & PRINTING INC. PUBLICATION • VOLUME 48 • ISSUE 7

Electrical Business

JULY 2012

Who is Lorne Scott, and what is he sitting in?

Also in this issue...

- Enhancing campus safety and preparedness
- Sources of non-traditional financing
- Ground fault protection versus detection

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Code volunteers are "germane and persuasive"

I would love for you to spend a few minutes online at our website, www.ebmag.com. There, you will find a ton of information—videos, photo galleries, new products, news, etc.—for which we simply do not have room in the magazine. While you're there, take a minute to subscribe to E-Line, our biweekly newsletter, which highlights a lot of the stuff we upload to EBMag.com, and that you may never see here in print.

Our Spring travel season is done, for the most part, but it need not be for you. Through our interviews, exposés, galleries, etc., at EBMag.com, you can vicariously attend all the conferences, tradeshows and special events you could not get around to attending yourself.

One such event is CSA's annual Conference and Committee Week—which I attended for the first time—and what an amazing experience. In truth, I did not know precisely what to expect going in, but upon seeing what I like to call the 'usual suspects'—people whose dedication to the electrical profession also takes them all over country—I knew I was in the right place.

Especially as the volunteer committee and subcommittee members for the Canadian Electrical Code, Part I—our bible—meet with one another to continue their important work on our ever-evolving electrical code. Here you have representatives from our territories, the East and West, inspection authorities, certification bodies, electrical associations, fire marshals, etc... and I say kudos to them.

As volunteers, you can imagine what the pay is like, but these dedicated professionals are not driven by remuneration. No, they are driven by something more. By and large, these committee members feel a profound duty to give back to industry. And while at times it may seem as though their discussions are "neither germane nor persuasive" (that's some committee meeting language for you), they flex their cumulative centuries of electrical experience to try to produce the best, world-leading standards and guidelines for electrical installations.

Members tell me of all the unpaid work they put into the committee, yet they unanimously agree it is perhaps the most rewarding work they've ever done. And they are always looking for new blood. If you're experienced, and have an interest in guiding our electrical bible in the years to come, I highly suggest you contact CSA's Canadian Electrical Code, Part I committee.

Mark your calendar now for CSA's 2013 annual Conference and Committee Week, June 16-18, in Calgary, Alta. EB

...they flex their cumulative centuries of electrical experience to try to produce the best, world-leading standards and guidelines for electrical installations.

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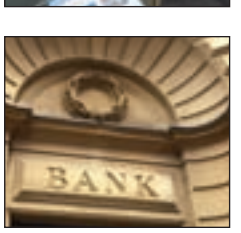
On the cover

While attending the Manitoba Electrical League's electrical showcase, we met with some volunteers involved with the Manitoba Electrical Museum, including Lorne Scott pictured here. But what is he sitting in? More on the museum and the MEL expo on page 7. Photo A. Capkun.



DEPARTMENTS

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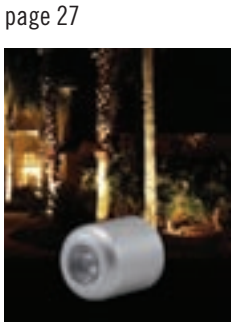

Building our future without personal protective equipment?

Just reading through our copy of this month's EBMag (May 2012) and one glaring issue jumped out at us from the front cover: children in an industrial work area, working with hand tools, cutting metal *and wearing no PPE?*

Even those of us who work in an office know better than to cut metal without eye protection!

Who allowed this to be printed and, more importantly, who put these children into such an unsafe situation?

— J. Walker, Elmira, Ont.

Electrical Business

July 2012 • Volume 48 • Issue 7

ELECTRICAL BUSINESS is the magazine of the Canadian electrical community. It reports on the news and publishes articles in a manner that is informative and constructive.

Editor
Anthony Capkun - acapkun@annexweb.com

Publisher
John MacPherson - jmacpherson@annexweb.com

Account Manager
Scott Hoy - shoy@annexweb.com

Associate Editor
Alyssa Dalton - adalton@annexweb.com

Art Director
Svetlana Avrutin - savrutin@annexweb.com

Production Manager
Kathryn Nyenhuis - knyenhuis@annexweb.com

Subscriber Customer Service Representative
Karen Thomson - kthomson@annexweb.com

President
Mike Fredericks - mfredericks@annexweb.com

Published by Annex Publishing & Printing Inc.
222 Edward Street, Aurora, Ontario L4G 1W6
Tel. 905-727-0077 • Fax 905-727-0017

Publication mail Agreement #40065710
Return Undeliverable Canadian Addresses to Circulation Department
P.O. Box 530, Simcoe, ON N3Y 4N5
e-mail: kthomson@annexweb.com

United States Second Class Postage paid at Lewiston, NY
(USPS-741-470) US POSTMASTER:
Send address changes to
ELECTRICAL BUSINESS,
P.O. Box 8145, Lewiston, NY 14092

Printed in Canada
ISSN 0013-4244

CIRCULATION: Karen Thomson
e-mail: kthomson@annexweb.com
Tel: 1-866-790-6070 • Fax: 1-877-624-1940
Mail: P.O. Box 530, Simcoe, ON N3Y 4N5

SUBSCRIPTION RATES:
Canada: Single issue $7.00
12 issues: $35.00 (includes tax)
USA: $59.00 (US)
International: $75.00 (US) per year

Occasionally, *Electrical Business* will mail information on behalf of industry-related groups whose products and services we believe may be of interest to you. If you prefer not to receive this information, please contact our circulation department in any of the four ways listed above.

We acknowledge the financial support of the Government of Canada through the Canada Periodical Fund (CPF) for our publishing activities.

Canada

CCAB BPA WORLDWIDE BUSINESS

WARNING: Counterfeit UL Mark on Power Fist 50-ft worklight string

UL (www.ul.com) is notifying consumers and retailers that a Power Fist 50-ft worklight string bears a counterfeit UL Mark for Canada and the United States. The product has not been evaluated by UL to the appropriate safety standard, so it is unknown whether the product complies with UL safety requirements for Canada and the States. The warning involves 340 units manufactured in February 2011 by Longkou Dongli Wire and Cable Co. of China. The following is printed in the box and engraved on the product:

LISTED
29XC
E256308

The description on the colour box also reads:

Power Fist 50-ft Work Light String
14/3 SJTW cord
Five 125 volt mounts with plastic ca ges
Max 150 watt bulb in each mount

The product is known to be sold at Princess Auto (www.princessauto.com).

West Coast Electric Highway expands to Washington and extends to Canada

The border-to-border vision of the West Coast Electric Highway in the States moved closer to reality today with the opening of new electric vehicle (EV) charging sites, extending the highway to the Canadian border and opening it to EV drivers from both countries.

The Washington State Department of Transportation (WSDOT), along with electric charging station partner AeroVironment (www.evsolutions.com), opened 10 new public charging stations: seven along Interstate 5 and three along U.S. Route 2 in northern Washington that provide EV drivers the ability to travel emission-free from Seattle to the Canadian border.

"Today moves us a giant step closer to the day when we can drive our electric cars from Bellingham, Wash., to San Diego, Calif., along Interstate 5, secure in the knowledge we can quickly recharge our vehicles along the way," said Washington governor Chris Gregoire.

Eight of the 10 new charging stations in Washington feature AeroVironment's DC fast chargers, which deliver a full charge for a nearly-depleted EV battery in less than 30 minutes. All locations include AeroVironment Level 2 chargers, which provide EV drivers with convenient charging while they grab a bite to eat, run errands, etc.

The West Coast Electric Highway is a vision for a transportation corridor from the Canadian to Mexican borders, connecting California, Oregon and Washington along I-5 that fully supports EVs.

"The West Coast Electric Highway is an outstanding example of public-private collaboration between partners including WSDOT, AeroVironment, local governments and businesses, and EV drivers," said Rogers Weed, Washington director of commerce. "Together our efforts are helping electric vehicle-related businesses emerge and grow, providing long-term energy and economic benefits for Washington state."

AECL marks 50th anniversary of nuclear power in Canada

On June 4, the Canadian nuclear industry marked an important milestone: the 50th anniversary of the first distribution of electricity generated by a nuclear power station. Congratulations!

At 1:31 pm on June 4, 1962, a switch was turned on and electricity from the 20MW nuclear power demonstration (NPD) reactor near Rolphton, Ont., flowed into the local power grid. This quiet occasion, made possible "through the facilities, expertise and innovation of AECL (www.aecl.ca)'s Chalk River Laboratories" said AECL, demonstrated the nuclear technology that—50 years later—continues to safely and reliably power the lives of Canadians.

NPD was built out of a partnership in 1954 between AECL, Ontario Hydro and Canadian General Electric. For 25 years, NPD served as a prototype for future CANDU designs, said AECL, and was an "important test facility for researching new fuels, materials, components and instruments".

From this partnership, an entire industry has grown, providing more than 71,000 jobs and $6.6 billion in exports in this country, adds AECL. Equally important, but perhaps lesser known, was that NPD was used for "training generations of Canadian and international nuclear staff on the safe operations of CANDU nuclear power plants all over the world".

For AECL, this small reactor represented the culmination of many years of R&D, and demonstrated the value—and the possibilities—that continued research in nuclear science would bring to Canada.

2012 is a milestone year for AECL as it also celebrates 60 years as Canada's premier nuclear science and technology organization.

Wesco acquiring Canadian-based Trydor Industries

Wesco International Inc. announced that Wesco Distribution Inc. (www.wesco.com)—through its wholly-owned Canadian subsidiary (www.wesco.ca)—has entered into a definitive agreement to acquire Trydor Industries (Canada) Ltd. (www.trydor.com), headquartered in Surrey, B.C. Closing is expected to occur in July.

With sales of about $35 million and offices in Surrey, Calgary and Edmonton, Trydor is a full-line distributor of high-voltage electrical products and services addressing the transmission, substation and distribution network needs for utilities, independent power producers and utility contractors in Canada.

"Combining the expertise and customer base of Trydor Industries and Brews Supply (which we acquired in October 2011) gives us a strong platform to grow our utility business in Canada," said John J. Engel, Wesco's chair and CEO.

A publicly traded holding company headquartered in Pittsburgh, Pa., Wesco International Inc. says it employs about 7300 people, maintains relationships with over 18,000 suppliers, and serves over 65,000 active customers worldwide.

Siemens Canada hosts Prairie West Technical Services open house

Photo (left to right): Michael Gross (Siemens Canada); Donna Mercer (Siemens Canada); Chris Dekker (Enterprise Saskatchewan); Robert Hardt (Siemens Canada).

Siemens (www.siemens.ca) officially welcomed Prairie West Technical Services into its family on May 17, hosting an open house at the newly acquired company's Regina head office. More than 50 guests, including customers and employees, were in attendance to learn about Siemens' current offerings, as well as be introduced to the expanded portfolio Siemens is now able to provide through Prairie West.

Jim Mayhew, director of operations at Prairie West, acted as emcee for the day, which began with remarks from Siemens Canada CEO Robert Hardt, who reaffirmed Siemens' commitment to its customers and to the Province of Saskatchewan.

"We are here to grow, and to bring our entire portfolio of solutions to our customers in the West," said Hardt. "Saskatchewan, and the West in general, is growing as a result of demand for its resources. The use of technology can help companies meet these demands—ensuring Canadian companies can keep a competitive advantage."

Michael Gross, SVP of Siemens Canada's Industry sector, also addressed the crowd, along with special guest, CEO of Enterprise Saskatchewan, Chris Dekker, who remarked on the Saskatchewan Advantage, confirming a strong partnership and plans for continued growth.

"Siemens' investment represents a second wave of economic development for the province—companies taking advantage of the supply-chain and value-added opportunities afforded by our rapidly growing resource economy. We welcome one of the world's most well-known and respected corporate citizens to Saskatchewan."

The acquisition of Prairie West Technical Services was officially announced by Siemens Canada in November 2011 to support Siemens' existing mining and oil & gas customers in Saskatchewan, and advances the company's technical capabilities in the region. Prairie West specializes in engineering solutions for the utility, industrial, commercial and institutional electrical markets.

Chatsworth Products expands into the Great White North

EBMag was there as global manufacturer of IT infrastructure equipment, Chatsworth Products (CPI, www.chatsworth.com), expanded its North American reach on May 15 with the grand opening of its first Canadian sales office and product showroom. CPI, an employee-owned company that manufactures voice, data and security products, as well as service solutions that optimize, store and secure technology equipment, hosted this grand opening under the theme "CPI Enters the Great White North".

"The quality of the facility is first class and very professional," said Stew Munns, CPI's national sales manager for Canada (in photo, 3rd from the right). "The environment is unique in the sense of having a raised floor data centre showroom. Customers really appreciate the

experience of being able to see a product as it would live in its natural environment."

Visit bit.ly/NeDiPQ for our Photo Gallery.

Located in Vaughan, Ont., the 3800-sf facility marks CPI's first bricks-and-mortar footprint in Canada with a sales office that includes a conference room equipped for product training sessions and—the facility's centrepiece—a state-of-the-art product showroom. Outfitted with a raised floor, TeraFrame cabinets, GlobalFrame cabinets, PDUs, Evolution cable management and OnTrac wire mesh cable tray and runway, visitors are given a sense of CPI products as they would appear in an actual data centre.

Led by Munns, the Canadian team also includes: Dave Wood, regional sales manager for Ontario and the Maritimes; Colin May, regional sales manager for Western Canada; and Colleen Birnie, office administrator.

"The most important investment CPI has made to date in Canada is in the local, in-country CPI employee-owners," said Larry Renaud, CPI president and CEO (in photo, 4th from the left). "We are very proud of the team that we have in Canada. We are pleased to have completed the additional investment in a new Canadian sales office and product showroom to further support the Canadian sales team's efforts in responding to IT Infrastructure growth opportunities in the Canadian market."

It's official - Osso Oshawa moving to Mar wood Drive

As we first tweeted in May 2012 during Sonepar Canada's Energy Saving & Environmental Week (bit.ly/JHj4sa), after 28 years at its 209 Bloor Street location, Osso Electric Supplies (www.ossoelectric.com)' Oshawa branch is moving to 361 Marwood Drive—2.3 km away from the current location.

Can't wait to see the new location? Check out the video rendering: bit.ly/JHj7UO.

"This move is a big change for Osso," said the distributor. "Our flagship branch has been a mainstay in the Oshawa area for many years, and it was difficult to make the decision to move."

Osso said it has outgrown its current building. "Instead of renovating and trying to make the building work for us, we're creating a brand new spot that is perfect for our needs. It's 21,500 sf, which means we've got a lot of room for ... more space, more inventory, more services, more parking..."

Osso said it intends to keep its customers and staff well informed on what' s happening with the move as it happens.

SaskPower and Kitsaki wrap-up 135-km transmission line clearing

SaskPower (www.saskpower.com) and Kitsaki Management Limited Partnership (www.kitsaki.com) say they have successfully wrapped up clearing a 135-km right-of-way in northern Saskatchewan—roughly the distance from Saskatoon to Prince Albert.

The 90-m wide path runs from Highway 102 near Brabant Lake to Key Lake, and will pave the way for a major new 300-km powerline designed to meet growing electricity demands in the north.

"We are very pleased to work with SaskPower on this important project," said Russell Roberts, Kitsaki CEO. "More than 250 good-paying northern jobs were created here. Along with that comes support for businesses and other suppliers in the north."

"A total of 180,000 hours were worked on this project without a single serious injury or lost-time incident," said SaskPower president and CEO Robert Watson. "This is a tremendous accomplishment, and I would like to congratulate Kitsaki and all of its employees on a job well done."

Winter clearing of the line began in January 2012 and wrapped up in late April. Fall clearing is expected to start in September 2012, pending Ministry of Environment approval. SaskPower estimates the new transmission line will be complete by the end of 2014.

BC Safety Authority reveals fee changes 2012-2014

From January to May 2012, the BC Safety Authority (www.safetyauthority.ca) says it consulted with clients and stakeholders on proposed fee changes for 2012-2014. Upon review, BCSA is moving forward with the following fee changes:

- 2012: 3% fee increase effective August 27, 2012
- 2013: 3% fee increase effective January 1, 2013
- 2014: 3% fee increase effective January 1, 2014

Refer to the documents at bit.ly/OJsZBC for a detailed account of the fee consultation findings and the fee schedules for each year.

"A thorough review to simplify our fee structure is presently taking place, and the BC Safety Authority will announce and invite feedback on the proposed changes during 2012," said the agency. "After review and consideration of consultation feedback, notification of approved fee structure changes will be provided later this year for effect in early 2013."

How DID they make Popcorn in the Early 1900s?

In 1971, a group of electrical professionals within Manitoba Hydro got together and formed the Historical Interest Committee, with the aim of preserving Manitoba's electrical heritage. Fast-forward several decades, and those humble beginnings have transformed into the Manitoba Electrical Museum & Education Centre.

Electrical Business was pleased to make the acquaintance of Darryl Willie, Lorne Scott and Darrell MacKay at the museum's booth at the Manitoba Electrical League's "Current Connections" electrical showcase, held a few weeks ago in Winnipeg. Located at 680 Harrow Street in Winnipeg, the museum is a volunteer organization composed of retired members of Manitoba Hydro and the electrical industry.

At EBMag.com, you'll find a video of Darryl Willie discussing the museum and its roots, and showing off some of the interesting heritage items that form part of the museum's collection. You'll also find another video of MEL's general manager, Gord Macpherson, discussing the benefits of MEL membership.

Oh, and our cover shows Lorne sitting in an early 20th Century, Ottawa-made 'Relax-A-Sauna'. EB


Douglas Dunbar

BICSI (www.bicsi.org) has appointed **Douglas Dunbar** to the position of VP of sales and business development. In this position, Dunbar will be responsible for generating new revenue, building a global sales team, cultivating long-term strategic partnerships and increasing marketplace visibility and stature by focusing on BICSI's products and services to add value for its customers.

Schneider Electric (www.schneider-electric.ca) has named **Alan Taaffe** director of Offer Marketing and Business Development for the Buildings Business in Canada. Here, Taaffe will be primarily accountable for developing the business development strategy, products and solutions offer, establishing and driving key business growth initiatives, and meeting the overall top line/margin results for the Buildings business. The 23-year-Schneider Electric veteran has held a variety of roles including customer support, training, logistics and marketing. For the last two years, Taaffe functioned as the manager of Marketing and Business Development for the Buildings Business.


Alan Taaffe

Cree (www.cree.com)'s **John Kurtzweil** has resigned as executive vice president-finance and CFO, effective May 21, to pursue an opportunity at **Extreme Networks** (www.extremenetworks.com), "a smaller firm where I can have a more hands-on role in growing the business, he explained. **Michael McDevitt** has been appointed CFO on an interim basis. Kurtzweil plans to continue as a Cree employee until June 15 to assist with the transition of his responsibilities. "The decision to leave Cree was a very difficult one for me as the past six years have been personally rewarding," he said. McDevitt joined Cree in 2002 as corporate controller and previously served as interim CFO in 2006 during an earlier transition. He has also served as Cree's director of financial planning and as director of sales operations.

Besides all the business conducted at **Affiliated Distributors** (www.adhq.com)' 2012 Electrical Divisions' Spring Network meeting in Phoenix, Az., the event also included the Electrical Divisions' Award Celebration. Congratulations to the following!

Greatest Remittance Growth (Canadian):
- WINNER: **BJ Electric Supplies** (www.bjelectric.ca)
- RUNNER UP: **B.A. Robinson** (www.barobinson.com)

Highest Participation Percentage (Canadian):
- WINNER: **Bartle & Gibson** (www.bartlegibson.com)
- RUNNER UP: **Jomar Electric** (www.jomarelectric.com)

K.R. (Kaj) den Daas, former chair of Philips North America, will be joining **Lighting Science Group** (ww.lsgc.com)'s board of directors. From 1977 to 2010, den Daas served in various capacities with Koninklijke Philips Electronics N.V., including chair of Philips Lighting North America, CEO of BU Professional Luminaires North America, COO of BG Lamps and executive VP of Philips Lighting B.V., CEO of Philips' Business Unit – Lamps for Europe, the Middle East and Africa, and the Asia Pacific. Den Daas is a member of the Illumination Engineering Society of North America, and from 2008 to 2010 served as governor of the National Electrical Manufacturers Association (NEMA, www.nema.org).


Kevin Cyr

CD Nova Instruments (www.cdnova.com) has appointed **Kevin Cyr** as Canadian product manager of its Power & Energy Division. Cyr has a Bachelor of Commerce Degree from the University of Calgary, Alta., and brings more than 20 years of experience in the technical sales instrumentation field, having worked nationally and internationally with other players in the industry.

CONGRATULATIONS CONTEST WINNERS!


Left to right: Sam Culin (ElectriXwest Agency); Dennis Schoenberger (EECOL); Alexander Penny (EECOL); Cliff Gehlert (EECOL).


Left to right: Jeremy Meyer (Lind); Mario Carnovale (Robertson Electric); Chris Campbell (Robertson Electric).

Lind Equipment (www.lindequipment.net) announced the winners of its recent 2012 IED Welcome Contest, which celebrated the company's addition as an IED supplier (Independent Electric Distributors Limited Partnership II). **Alexander Penny** of **EECOL** (Calgary Main, Alta.) and **Mario Carnovale** of **Robertson Electric Wholesale** (Vaughan, Ont.) were the two winners of the nationwide contest. Each won a new 55-in. Sony Bravia LED HDTV.


Left to right: Dave Ostien (Schneider Electric); Leif Hanson (Hanson Electric); Trevor Hartley, branch manager (Eecol Red Deer).

Leif Hanson of **Hanson Electric** (Red Deer, Alta.) has won a $10,000 travel voucher as a grand prizewinner in **Schneider Electric** (www.schneider-electric.ca)'s Homeline "Load up to Win" contest. Congratulations! The contest ran from June 1 to December 31, 2011. Those purchasing a Homeline loadcentre could complete the Load up to Win ballot for each purchase, and deposit the ballot into their distributor's ballot box to be eligible to win a monthly prize and the grand prize. EB

Dan Leduc

Integrated Project Delivery a.k.a. Lipstick on a Pig?

I recently attended the American Bar Association Construction Industry Forum Annual Conference at which a variety speakers delivered papers on current topics and trends in the industry.

One topic *du jour* involved the increased use of the Integrated Project Delivery (IPD)[1] model. Although it is not new, it seems the American construction industry is taking more notice of IPD with the advent of Building Information Modelling (BIM) and Lean Construction models. In what American construction lawyers characterize as a "seminal shift" toward use of IPD, it's heavier use in the States means it will likely come into prominence here.

IPD employs methodologies that emphasize collaboration between multiple stakeholders to achieve the project delivery and construction. By fostering a team mentality (remember 'partnering' of the late 1980s and early 1990s?), it stands wholly apart from the separation of design and construction and the adversarial relationships that traditionally epitomize currently project delivery models. It is a method of delivering project design and construction that:

> integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction.[2]

IPD has stepped to the forefront of potential project delivery methods in the United States (during this new millennium) to address the urgent need to reduce the tremendous amount of inefficiencies and waste that currently plague the design and construction industry. And, although there are still many skeptics within the industry who are reluctant to move away from traditional ways of doing business, the industry's current state dictates that change is necessary.

The largest impetus for the use of IPD relates to current problems associated with design-build projects. The conference focused on the fact that current models for design-build foster litigation, are fragmented and inefficient, and continue to foster an adversarial relationship between the owner and design-builder.

IPD employs a relational, value-based contracting approach by creating a virtual organization where the key project participants' interests are aligned with defined project objectives, and both collaboration and innovation are encouraged between the various team members throughout the design and construction process through a shared financial stake in the project outcome.

Common themes for project outcomes employing IPD are a reduction in overall project cost and time of delivery, increased quality of workmanship, and success in

meeting sustainability and life cycle goals. In other words, IPD projects are typically on time, on budget, higher quality, have fewer requests for information and change orders and, so far, no litigation.

This is because IPD "addresses the entire sequence of programming, design, construction and building operations"[3] through a tri-party, relational, value-based contract that requires mutual respect and trust among participants, transparency in project costs and financials, and open communications, collaboration and innovation among project team members.

This is a paradigm shift from traditional contracting methods and, while it may sound too good to be true, it looks as though IPD addresses some of the drawbacks linked to notions such as partnering.

The IPD paradigm uses trust-based teams comprising key participants that are engaged early in the design process to optimize and inform the design, and execute construction with greater efficiency and precision.[4] And, unlike partnering, the contract is value-based, because each of these key participants has shared incentives for success or financial risk for failure. So the contractor, designer and owner all have skin in the game. As a result, risk allocation is balanced and open communication is achieved: two key goals for the success of any project.

However, IPD is not for everyone nor the solution for every project. For starters, it comes with increased upfront costs; although these costs are eventually recaptured due to increased value and efficiencies, whether the additional upfront costs are acceptable to an owner depends on the type of owner and facility, available project financing, and project duration.

IPD projects also require an increased time commitment and more leadership from the owner, and not all owners have the capacity or desire to participate at this level. That is not to say, however, that other project delivery methods such as design-build and construction management at risk could not also benefit from adopting several of the key elements required by IPD.[5]

You may recall back in 2008, during the American Presidential race, when Barack Obama told a crowd at a campaign event: "You can put lipstick on a pig, but it's still a pig". Are we getting closer to a better project delivery model with IPD, or are we simply applying more lipstick? EB

Dan Leduc is a partner at Norton Rose LLP and co-chair of the firm's Canadian Construction Law Practice Group. He is frequently called upon to advise and represent owners, engineers, subcontractors, suppliers and builders in such front-end services as contract review, tender issues and general construction matters, as well as in litigation and arbitration. Dan can be reached at (613) 780-1536 or dan.leduc@nortonrose.com.

Notes

1. In preparing this column, I rely heavily on a paper called "Integrated Project Delivery: The Game Changer", written by Joseph a Cleves Jr. and Lisa Dal Gallo.
2. "Integrated Project Delivery, A Working Definition", AIA California Counsel, McGraw-Hill Construction, version 2, updated June 13, 2007, p1.
3. "Integrated Project Delivery Case Studies", AIA California Council, January 2010 pp10-52.
4. Rex Miller, Dean Strombom, Mark Iammarino, and Bill Black, "The Commercial Real Estate Revolution", published by John Wiley & Sons Inc., 2009, p68.
5. Supra note 1, p16.

Dave Smith

Maintain your equipment; reduce your risk

Part four

At the beginning of this series I explained the rationale for an overview of maintenance, since studies indicate that 66% of unsafe incidents can be attributed to maintenance-related issues. The field is so large I have divided it into this series aimed at managers new to electrical maintenance.

In my first article, I referenced the work myself and other maintenance specialists are providing to CSA in the development of a national maintenance standard entitled CSA Z463, Guideline on Maintenance of Electrical Systems.

The next two articles referenced maintenance standards developed by IEEE and NFPA. In this article I will reference PEARL, a less commonly known organization yet still a key component of our industry.

PEARL is the Professional Electrical Apparatus Recyclers League whose member companies sell surplus and remanufactured electrical equipment. Most of their members are in the United States, but there are some in Canada as well.

PEARL (www.pearl1.org) is like many professional organizations; they are focused on servicing their members by distinguishing their services from those of non-members by creating a marketable distinction in quality, safety and integrity for members in the eyes of their customers.

Small plants can judiciously extend their capital budget with surplus or remanufactured products, so buying from a PEARL member can be judicious from both cost and reliability standpoints.

To differentiate their members from other surplus suppliers, PEARL has developed standards that ensure their members meet strict technical, safety and other requirements. To achieve this goal, PEARL has developed two standards.

The first set of standards are the PEARL Reconditioning Standards, which provide inspection, cleaning, reconditioning, testing and documentation instructions for an extensive range of electrical apparatus and equipment. The intent is for qualified technicians to be able to return electrical devices to 'as good as new' condition without compromise, thereby enabling purchasers to benefit from extended service life and reliability.

PEARL has created a blue PEARL Reconditioned Seal that the technician affixes to equipment after it has been rebuilt to these standards. (Non-PEARL companies can certainly rebuild to the same level of quality but, if they claim to, then they should be willing to share their standard with you as does PEARL.)

The second set of PEARL standards are the Inspect and Test Standards, which provide inspection, cleaning, testing and documentation instructions and guidelines for the same range of equipment.

These standards can be used by your plant technicians to determine whether an electrical device is free from flaws or faults, and whether the equipment would be suitable for full reconditioning by proving that the equipment shows no indication of damage and tests satisfactorily to manufacturer or industry operational specifications.

It doesn't matter whether the equipment is new, surplus or has been in service and, in fact, can even be applied to equipment purchased from non-PEARL suppliers.

For companies that have no shop or field inspection guideline, it can be used to predict and avert future failures by calling attention to elements of the equipment or device that fail during testing.

> PEARL members have invested thousands of hours developing these standards, and they should be part of every maintenance manager's library.

PEARL has created a green PEARL Inspected & Tested Seal that the technician affixes to equipment that has passed the PEARL Inspect and Test standards.

The league becomes especially valuable in a world of counterfeit and fraudulent electrical equipment; these knockoff items are rampant, hard to identify and particularly malicious when they happen to be protective devices that will never respond properly to a fault.

For any organization working within a restricted budget, there is good news regarding these standards: PEARL allows them both to be downloaded free of charge. There is no sense reinventing the wheel; PEARL members have obviously invested thousands of hours developing them, and they should be part of every maintenance manager's library.

These are both excellent standards and their proper use is guaranteed to reduce those 66% of safety incidents attributed to maintenance-related issues.

Until next time, be ready, be careful and be safe.© EB

Canada Training Group has been providing consulting services to industry since 1980; Dave Smith, the president, can be reached at davesmith@canada-training-group.ca. At www.canada-training-group.ca, you will find this article (and others) to help support your own safety initiatives.

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DIVE INTO THE WORLD OF MOTORS!

PHOTO A
These DC motors have two leads. Direction may be changed by reversing polarity.

PHOTOS JUDITH HOWCROFT

David Herres

Electric motors achieve rotary action by means of the interaction of magnetic properties within the stator and the rotor. There are many variations in how the transfer of electrical and magnetic energy within a motor takes place, so almost any statement we make is going to have exceptions, but the basic principles always apply.

The stator is the electrical apparatus mounted on the inside of the stationary (non-rotating) part of the motor, and the rotor is mounted on front and rear bearings inside so that it is free to turn. Typically, copper coils comprise the stator, and current from the electrical supply produces a magnetic field that influences the rotor. The rotor may also have windings so that a magnetic field is created to interact with the stator's magnetic field, causing rotation to take place.

Other rotor scenarios include permanent magnets or soft iron material which is highly permeable to magnetic flux, meaning that it will interact with the stator's magnetic field and, therefore, will turn and be capable of driving a load. The idea of an electromagnetic rotor is highly appealing except for the fact that current from the power supply has to get into the rotating part of the motor, which may be problematic. Were the rotor to be wired directly, the wires would quickly twist and break off.

The solution is to have brushes that contact the turning commutator and permit the transfer of power. There are usually two brushes, one for each pole. In theory, it would be possible to have the neutral return flow through the bearings, but such an arrangement would not be practical since such current could cause arcing and early bearing failure. Moreover, neutral voltage must be isolated from the motor housing and equipment ground.

Because the brushes and springs that hold them with moderate pressure against the commutator are fairly active mechanically and electrically, they are subject to failure and have a finite life expectancy. Fortunately, replacements are usually readily available and are easy to change.

Taking a step back

We should back up a little and talk about some motor variations, as not all motors have brushes. There are other ways to get the energy into the rotor and for it to turn without being electrically connected to the outside world.

The principle types of motors are DC, synchronous, induction and stepper. Rather than having an electromagnetic rotor, there can be one or more permanent magnets. This arrangement eliminates the need for an electrical feed into the rotor and, hence, the need for brushes. It is not possible to have permanent magnets in both the rotor and the stator. Were such a motor built, it would go only a part turn, at best, then remain at rest forever. There is no way to commutate polarity in a permanent magnet without physically turning the magnet; the energy required to do such an operation being greater than the output of the motor. Otherwise, we would violate the law of conservation of energy and, thereby, build a perpetual motion machine. To achieve motion, outside line-supplied energy has to be inserted into the system on a continuous basis.

It would be a very misguided idea to have permanent magnets in the stator and feed current into the rotor since the object is to avoid the need for brushes.

Electric motors were conceived long ago, over a period of many years, and definitely preceded the Tesla-Westinghouse development of AC generation and distribution. The first motors had to be DC. These motors have advantages and disadvantages and, even today, their use remains widespread—most notably in automotive starters, but also in elevators, ski lifts, inkjet printers, battery-operated toys and many other applications. DC may be supplied from a battery, solar PV system, DC generator or utility AC power that is locally rectified to power a single motor or group installation (Photo A).

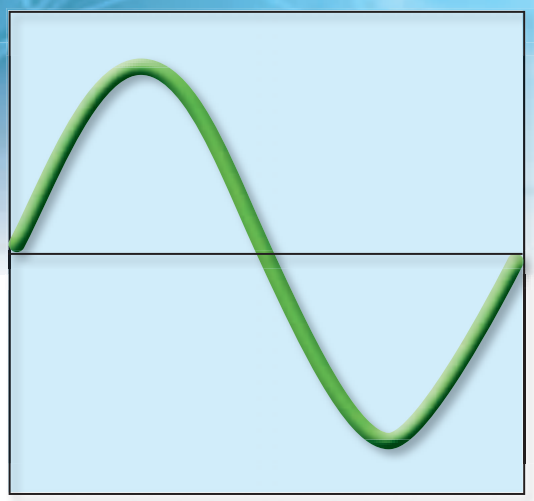

PHOTO B
Electrical current as depicted graphically as a sine wave has all its energy confined to a single frequency with no harmonics.

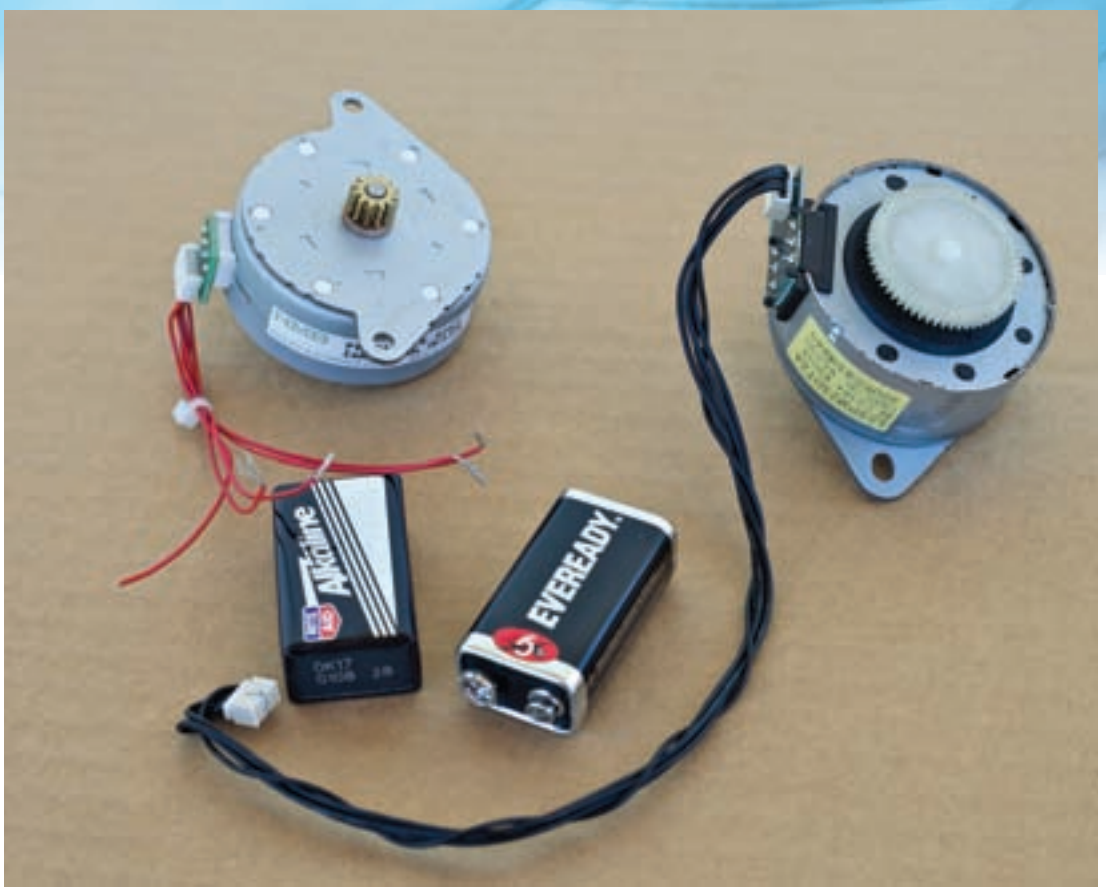

PHOTO C
Two small stepper motors taken from inkjet printers may be pulsed manually for testing using a 9V battery.

Generally, DC is fed to the stator coils, where a stationary field is maintained. Electricity is also supplied to the rotor, but the field cannot be stationary, or the motor would fail to turn. Accordingly, there has to be a switching action that takes place either inside or outside the motor housing whereby the rotor field is periodically reversed. The fact that opposite magnetic poles, north and south, attract while like poles repel makes the rotary motion of the DC motor possible.

Motors and their pros and cons

AC motors may be synchronous or induction machines, the latter of these being far more common. Both require alternating current to work.

The idea of a synchronous motor is very appealing. The switching of magnetic fields takes place because of the nature of the AC power supplied by the utility or an onsite generator. AC so acquired takes the form of a sine wave, which has a distinctive appearance when represented graphically (Photo B).

Notice that the rate of change is greatest when the voltage is closest to zero, and the rate of change is least when the voltage is at its positive and negative peaks. The sine wave takes its form due to the rotary nature of the AC generator. The waveform is free of abrupt rise and fall times, as in a square wave and, for this reason, there are no harmful harmonics unless created by inductive or solid-state switching loads.

The rotor poles are always chasing after the stator poles, and no mechanical switching is necessary since the current reversals are inherent in the supplied AC. Thus, shaft rotation is synchronized with AC supply frequency, usually 50 Hz or 60 Hz. The period of rotation is equal to the frequency of the AC supply or an integral multiple of that number, based on the number of magnetic poles. High rpm becomes possible and speed will remain constant with great accuracy. Speed cannot be changed merely by varying the voltage. It is necessary to vary the frequency, which can be done externally.

Since the rotary motion of a synchronous motor depends upon line frequency, there is a problem getting some synchronous motors to start. In smaller sizes, where the rotor has little inertia of rest, they will start themselves as soon as they are connected to the supply. Larger synchronous motors are separately DC excited, or they may have a small auxiliary (pony) motor to bring them up to speed.

Large synchronous motors have definite advantages. They are quite efficient and, with leading power factor, they contribute to power factor correction, helping to reduce the cost of electricity in a large industrial facility.

Far more numerous in all types of settings are induction motors. These also require AC to operate, because the strategy for getting power into the rotor is to induce current flow in the rotor windings. In this way, the induction motor resembles a transformer, with the primary being the stator and the secondary being the rotor.

The rotor windings take a totally different form. They are closed loops. There is no speed or phase synchronization with the line frequency, although the speed is proportional to the line frequency since the stator is connected to the AC power supply as in a synchronous motor, and there is a rotating magnetic field.

Induction motors are also called asynchronous motors, and this emphasizes that they are distinct. Since power is transferred by means of electromagnetic induction rather than slip rings or brushes, induction motors are mechanically simpler, more economical and maintenance-free than their synchronous counterparts.

A general term for induction units is 'squirrel cage motors', and this terminology has become widely used.

Single-phase induction motors are used in consumer appliances and stationary tools. Polyphase versions are ubiquitous in industrial facilities where simple, non-synchronized rotary power is required for compressors, pumps, fans, blowers and all sorts of motor-driven equipment.

An induction motor stator, as mentioned, is powered by AC line current, single- or three-phase. There is a rotating magnetic field that is always synchronized with the supply. In an induction motor, the rotor is not synchronized, and turns more slowly.

Were the speed of the rotor the same as the stator's rotating magnetic field, as in a synchronous motor, there would be no relative motion between the two structures and, hence, no induced current in the rotor's closed loops. Such motion, then, is impossible. The rotor's speed is always slower than the stator's rotating field, and this difference in speed is called 'slip'. For a small induction motor, the slip will be about 6%; for large induction motors, it is more like 20% at full load.

Induction motors, accordingly, are noted for excellent speed regulation (they are constant-speed motors) despite the fact that they are not synchronized to line frequency. This is assuming that they are not loaded in excess of rating. Beyond 20% slip, an induction motor will stall and, if power is not disconnected, severe overheating will occur as the magnetic coils become heating elements.

Single-phase induction motors often have two separate windings in the stator. One of these is fed through a capacitor so that its supply voltage is 90 degrees out of phase, facilitating magnetic field rotation. These motors, therefore, require a run capacitor.

Polyphase induction motors are self-starting since there is torque even at rest. Single-phase induction motors, on the other hand, require assistance in starting. This may be

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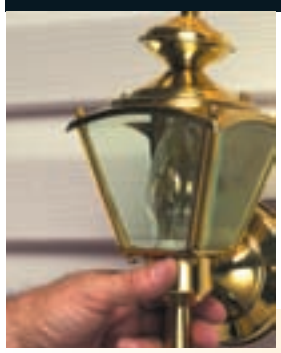

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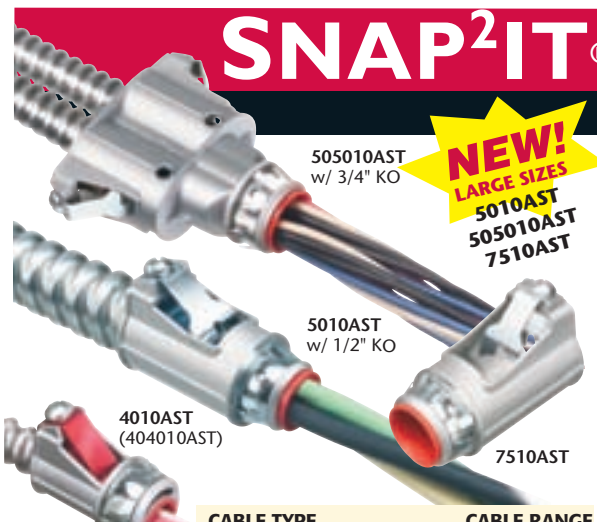

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PHOTO D
Old-style satellite dish has a large stepper motor to aim the dish at various points in the sky.

accomplished by means of a shaded pole, where a single turn of wire surrounds part of the pole so that the current lags the main supply, providing enough torque to start the motor. Shaded-pole starting is common in small motors. Larger single-phase motors incorporate a starting capacitor that is taken offline by means of a centrifugal switch or other means once sufficient speed is attained.

So we see that there may be start and run capacitors in separate start and run circuits. Switching may be accomplished by solid-state timing or heat sensors.

An interesting and useful variation is the universal motor, so-called because it will operate on AC or DC. It can be controlled electronically from outside or inside the motor by phase-angle drive or chopper drive.

For their power, these motors come in small sizes. Through a commutator, the stator and rotor windings are connected in series. Because the rotor is brush fed—and also due to high rpm—these motors require more maintenance than induction motors.

Universal motors have a characteristic whirring sound. Applications include many small portable hand tools such as electric drills, as well as food blenders, vacuum cleaners and, in large sizes, electric train locomotives. Besides electronic means, it is often possible to control the speed merely by varying the voltage.

Still another variation is the stepper motor, a brushless DC motor whose commutation takes place outside the motor by means of pulses supplied by a controller (Photo C). The distinguishing characteristic of a stepper motor is that motion occurs in discrete incremental steps that are a fraction of a turn.

Each pulse makes the motor advance one step. Rather than a rotating magnetic field, the stator—with multiple electromagnets comprising a ring—emits one or more short magnetic pulses of either polarity, depending on the electrical input.

In its simplest form, the rotor consists of a gear-shaped or toothed piece of soft iron. This metal has high magnetic permeability and is attracted to the nearest energized stator pole. The number of stator poles and rotor teeth determine the angular motion or size of the incremental steps and hence the resolution of the motor.

The machine described is a variable reluctance stepper motor. (Reluctance is a measurement of opposition to magnetic flux in a magnetic circuit just as resistance is a measurement of opposition to current flow in an electrical circuit.) Other stepper motor types include permanent magnet stepper motors, with permanent magnets in the rotor, and hybrid stepper motors with elements of both in the rotor construction. In all cases, the stator is conceptually the same.

The electromagnetic coils may be unipolar, with a centre tap in each phase, or bipolar, with no centre tap. A unipolar stepper motor may be operated in bipolar mode by disregarding the centre taps.

Stepper motors are very reliable and maintenance-free, since the commutation is external and there are no brushes. However, external drive circuits are required to generate the correct pulses and apply them to the appropriate wires in sequence to obtain the desired motor operation. The controller can actually supply audio frequencies to make the stepper motor rotate at a significant rpm.

Stepper motors are used in ink-jet printers and other office equipment, astronomical telescope clock drives, solar array positioners and the old-style satellite TV dishes, which were required to point to different points in the sky depending upon the channel desired (Photo D). Stepper motors are not usually repairable and must be replaced in the unlikely event of failure. They may be tested by pulsing manually with a battery of appropriate voltage.

Non-stepper motor maintenance consists of lubricating the bearings when required. Over-oiling is harmful because, were excess oil to get on the brushes, it would soften them, leading to rapid wear. Also, excess oil inside the motor collects dirt, which can form an insulating layer allowing for temperature rise, or an electrically conductive layer that will short out terminals. Infiltration of sawdust and the like can prevent mechanical switching and also cause overheating.

Frequently, in an electric fan or similar machine, the motor will not start, and it will be found to turn hard by hand. People say the motor is burnt out, but in a high proportion of cases, the bearings are dry and just need a little lubrication. Start with penetrating oil and follow up with a heavier machine oil. Do both front and rear bearings and you should be good for a long time. This ailment frequently affects newer motors with tight bearings.

A good maintenance program in an industrial facility will include monitoring bearing temperature, checking motor mounts and drivetrain alignment to see that the motor is operating efficiently, ascertaining that air circulation is not impeded, and checking that any guarding is in place so that worker safety is not compromised. EB

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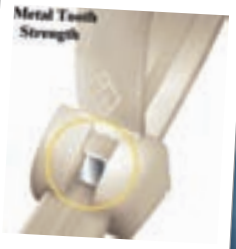

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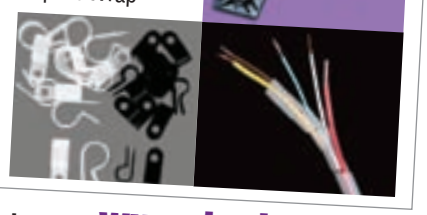

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Reliability prediction considerations for LED ELECTRONICS

Dr. Jack Josefowicz

Reliability is often misunderstood and misused because there have been many different approaches and methods developed for predicting failures in electronics systems. There is often confusion when discussing reliability prediction for electronic systems because the failure rate is dependent on the method used for analysis. Further, for all the widely used methods listed in Table 1, the calculated Mean Time Between Failure (MTBF) for an electronic system will have varying—and sometimes large—differences in MTBF values.

Of the methods listed in Table 1, Telcordia SR332 has become one of the widely used and most popular tools for reliability prediction. It was first developed at AT&T Bell Labs some 40 years ago to help understand reliability in telecom systems. It continues to be one of the most relevant reliability prediction methods, and is continuously updated so that it encompasses new information about component reliability and its ratings as new integrated circuit component and electronic components are introduced into the market.

The company, Telcordia, provides consulting in electronics, electronics research, develops and provides open standards, logical software and electronics design. The Telcordia SR332 method for reliability prediction is used in many electronics fields, by both manufacturing companies and their customers, including telecom, aerospace, fire and safety electronics, medical electronics, space communications, automotive, and many other fields where reliability and long life expectancy is important.

TABLE 1: Some popular reliability prediction methods

- **MIL-HDBK-217F** Parts count only
- **MIL-HDBK-217F** Parts stress only
- **MIL-HDBK-217F** Both Parts count & Parts stress
- **Bellcore TR332**
- **Telcordia SR332**
- **Bellcore TR332** and **Telcordia SR332**
- **Siemens SN29500**
- **British Telecom HRD4** and **HRD5**
- **Field Returns**
- **Life Testing**

All electronic systems have a failure rate (^ lambda), which is the number of units failing per unit time. This failure rate changes throughout the life of the product. Initially, during manufacture of the electronic system, there may be assembly, connector, faulty component and other problems that can lead to early failure, or the 'infant mortality period (IMP)'. All manufacturers strive to send product to customers in the field that will not have failures related to infant mortality.

To mitigate IMP failures, intensive and well-designed quality assurance and testing must be done to weed out IMP-related failures. Where LED electronics are concerned, power supplies should be put through functional testing prior to assembly into lighting fixtures. A variety of parameter checks assure that IMP-related failures in the electronic system are caught and not shipped to customers.

This leaves a product with a 'useful life period' during which failures occur randomly i.e. ^ is constant. Once the electronic system and its component reach 'end of life' (the wear out period), the electronic system useful life is ended and this is where ^ begins to increase dramatically.

The Telcordia SR332 method, as well as the other methods in Table 1, uses calculation strategies that include input of the life (reliability) rating for every single electronics component that is identified to be part of the electronics system. In the design of any electronics system, the selection of components and their reliability rating is critical to the calculated value of MTBF, which determines the failure rate, ^.

Some commercial capacitors are rated for 26,000 hours (about 6 years) at 85°C operation, while aerospace-rated capacitors may be rated to 110,000 hours (>20 years) at 85°C. When every component in an electronics system is selected with the same high reliability and long life requirement, the overall system failure rate will be lower than a commercial low-cost system where component selection is primarily influenced by low cost, and useful life expectancy is targeted to be just beyond five years.

Other reliability factors

There are other reliability factors that impact overall system reliability and failure rate that are often not included directly in the reliability prediction models discussed above. They include printed circuit board (PCB) design and PCB materials selection, overall PCB layout and design for maximum reliability over the life of the system (e.g. thickness of copper traces, size of spaces between traces, type of dielectric material used and its temperature rating).

Furthermore, other design- and component-related reliability issues stem from the selection of connectors and other hardware. For example, when the DC output wires from the power supply are not vibration-proof or waterproof, either vibration or electro-galvanic reactions in a wet environment could lead to a system failure, even though the rest of the electronics system is functioning properly.

Calculating Mean Time Between Failure (MTBF)

To calculate MTBF, strict guidelines are defined by the reliability prediction method used. The value of MTBF for an electronics system depends upon the number of parts in the electronics system, the reliability rating of each part, the stress condition defined for the operation of the system, as well as the operating temperature in the field. During the electronics system's useful life period—assuming a constant failure rate—MTBF is defined as the inverse of the failure rate, and they can be used interchangeably:

^ =1 / MTBF

Often, MTBF is misunderstood to mean a minimum, guaranteed time between failures. This is not correct. The parameter MTBF is used to calculate reliability (R) through a simple exponential distribution equation as follows:

$$R(t) = e^{-t/MTBF}$$

where
t = time product is in the field, and
e = the exponential function

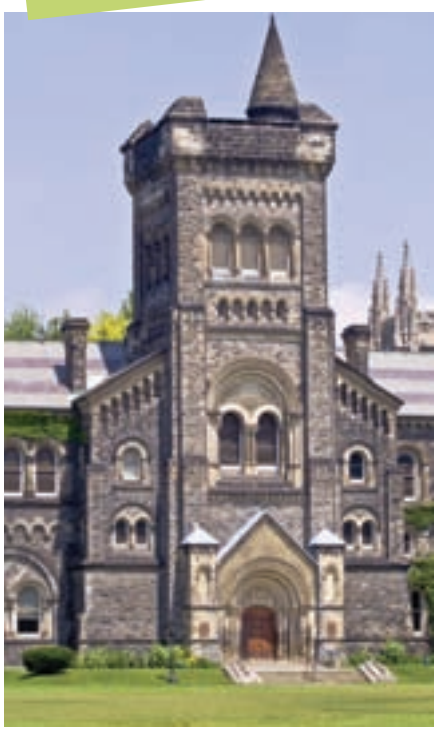
For example, when the calculation of R for an electronic system at a particular operating temperature is 0.96, it would result in reliability of 96% of product in the field. The MTBF does depend on the operating temperature (the higher the operating temperature, the lower the reliability), so that the overall design of the thermal management system—both for the LEDs and the power supply—is a critical design element of any LED light fixture.

In summary, top-quality LED should be designed with high-reliability power supply drivers. They should be designed with high-reliability components and attention to environmental stresses (e.g. vibration, aggressive thermal cycling, high and low temperatures, high humidity, salt spray). As such, do your homework when specifying and purchasing LED luminaires. EB

Dr. Jack Josefowicz is the executive vice-president, technology solutions, with LED Roadway Lighting Ltd., a developer of LED-based street and area lighting fixtures and control systems. The company is located in Nova Scotia, with R&D facilities in Halifax and a 55,000-sf manufacturing facility in Amherst. Visit www.ledroadwaylighting.com. This article based on the paper "Reliability Prediction Considerations Overview" published January 4, 2012.

Enhancing campus safety and preparedness

12 recommendations for developing effective short and long-term solutions



The issue of safety on campus has come to the forefront as never before. Many institutions are taking stock of existing life-safety systems, planning and processes as they evaluate what might need to be done to enhance campus protection and overall emergency preparedness.

Here is a set of recommendations to help guide the strategies and action planning of colleges and universities as they move forward at this critical juncture.

#1 Avoid short-term thinking and the impulse to find a single-technological solution

With the heightened focus on campus safety, institutions can expect to be approached by numerous suppliers of products and technologies. While it may be important to implement certain safety enhancements promptly, your decisions should be rooted in the larger overall life-safety picture and its long-term implications.

#2 Think about your campus in its entirety

Unfortunately, no part of a campus is invulnerable to a threat. In addition to classrooms, residence halls, laboratories and administrative buildings, a robust life-safety protection solution should also address outdoor areas.

Today's technologies enable your institution's buildings and properties—including offsite satellite operations—to be networked. With networked systems, a centralized command centre can be a valuable asset as an organization directs its response to emergencies and coordinates the efforts of outside responders.

#3 Emergency response may need to extend beyond the campus

A comprehensive emergency response capability may include notifying commuting staff and students via radio, Amber Alert messages and/or perimeter checkpoints. Emergency response may also involve the notification of administration personnel during off-hours and automated email and cell-phone alerts as an event unfolds. Keeping people out of harm's way can be as important as responding to the threat itself.

#4 Be sure to involve all stakeholders

Many different groups within your institution have a role to play in formulating a plan to enhance campus safety and preparedness. Security, facilities management, IT, in-house engineering and student housing departments can all contribute valuable input. Faculty, staff and student constituencies should also be involved. It's important to obtain input and buy-in from all these groups—not only in the planning stage, but as decisions are reached and implemented.

Finally, don't forget students and parents; keeping them informed of progress will allow you to demonstrate your institution's commitment to safety.

#5 Actively promote internal cooperation

It will be important to involve senior administrators to help overcome potential interdepartmental

barriers that could hinder planning and implementation of your campus safety planning and preparedness effort. From the start, be sure to inform and educate your senior leadership on this initiative. They should be involved in establishing the tone for the program, directing their teams to pull together, and maintaining oversight going forward.

#6 Consider a phased approach that leverages your existing fire alarm infrastructure

For many institutions, funding a comprehensive life-safety solution all at once is unrealistic in the short term. It may be possible, however, to start by implementing key enhancements within a larger, phased program. In particular, adding campus-wide voice notification capabilities to the existing fire alarm infrastructure is considerably less costly than the upfront expense of installing a stand-alone emergency address system. Moreover, it can be accomplished rather quickly.

Voice-enabled fire alarm systems have been used for decades to provide mass notification for fire conditions, severe weather alerts, chemical spills and other emergencies. Leveraging your investment in fire alarm to handle indoor/outdoor voice messaging is a practical, cost-effective way to produce a measurable improvement in campus safety.

#7 Explore alternative funding mechanisms

The United States, for example, the Department of Homeland Security makes grant money available for campus safety improvements. The costs for enhancing campus safety and preparedness can also be proposed to your alumni for targeted fundraising. Leasing can also is another potential option that can be considered for financing a campus life-safety initiative. Leasing can enable you to proceed with a campus safety upgrade through the annual budgeting process without straining the institution's capital budget.

#8 Consider code compliance in your planning

While fire and building codes have been in place for decades, emergency communications systems are subject to emerging standards being developed by industry organizations such as NFPA and UL. Furthermore, some American states are requiring fire sprinkler retrofits for dorms, and still others are taking steps to pass laws specific to campus safety. As you plan and implement a life-safety systems upgrade, be sure the suppliers involved in the project are up-to-date on emerging codes and regulations.

#9 Future-proof your investment for expandability

Ideally, the life-safety systems solution you put in place today should be flexible enough to grow and expand as the campus' changes and needs evolve. This flexibility requirement can be addressed in part by standardizing on a scalable platform that is designed to accommodate expansion. It's also important to implement technology that is forward and backward compatible, thereby providing long-term protection for the investments you're making in life-safety systems.

#10 Don't overlook training

It will be important to acquaint students, faculty and personnel with campus safety systems and procedures. Add periodic security evacuation drills to your school's schedule and include explanatory information in campus orientation materials–residence hall advisors can point out the location of emergency call stations and/or duress buttons in each dormitory and review the appropriate response to emergency sirens, strobe signalling and emergency text message displays.

#11 Make sure you factor in system maintenance

Routine inspection, maintenance and repair are fundamental to keeping life-safety systems in top working order for an emergency situation. Such testing is generally mandated by codes and regulations. Choosing a suitable service provider and scheduling regular service activity should be viewed as vital components of your campus safety initiative. It may also be advisable to choose an organization that is able to service multiple fire, communications and security systems, which can streamline the process and provide operational benefits.

#12 Market your campus safety improvement

As you strengthen campus safety and preparedness, it may deter the incidence of crime. Information relating to improvements in campus safety can be incorporated into your communications to potential students, parents, faculty and employees. With today's elevated security awareness, your campus safety initiative can definitely be a factor in enhancing the reputation of your institution and attracting students, faculty and staff. EB

– With files from a paper by SimplexGrinnell

INFRARED THERMOMETERS

for electrical, industrial and HVAC applications

In general, there are three ways to use any kind of infrared (IR), non-contact thermometer:

1 **Measuring the temperature at a spot**
This type of measurement is used to measure and track temperature at a single spot. It is useful for trending the temperature of an object or comparing a measurement to a specification. A thermometer with high repeatability helps ensure consistency for this kind of measurement.

2 **Comparing the temperature of two spots**
This type of measurement might be used to check the functioning of a steam trap by measuring the temperature of the inlet and outlet. No change indicates the trap has failed open. A very large change indicates the trap has failed closed.

3 **Scanning an object and detecting changes within a continuous area upon it**
This capability allows the user to find hot or cold spots on housings, panels and structures. For example, one can check the heat sink of air-cooled transformers for cool tubes that indicate a restricted flow or a lack of flow.

Applications for IR thermometers

Infrared thermometry can be used for process monitoring, plant predictive & preventive maintenance, electrical applications, quality assurance, and more.

IR non-contact thermometers are ideal for moving targets and machinery, hazardous and inaccessible or distant targets, electrical components, 'big picture' evaluations of machinery or surfaces, trending records, and even protection against litigation and insurance claims. In fact, insurance companies are encouraging their customers to implement preventive infrared scanning.

IR thermometers and imagers can save time and money for contractors and customers alike, as well as perform diagnostics that were previously impossible without shutting down systems.

Here are some suggestions for applications in which IR non-contact thermometers have proved useful:

Electrical maintenance

- Check for heat buildup created by loose connectors.
- Troubleshoot problems in battery banks and power panel terminations, ballasts, switchgear and fuse connections.
- Identify hot spots in the output filters on DC battery connections.

They can be used to inspect supply power connections and circuit breakers (or fuses) for equal temperatures. They are effective in determining the source of the problem when a thermal overload protection device does not work and the motor shuts down. Because electrical currents generate heat, temperature monitoring is an efficient way to predict potential equipment failure.

Equipment maintenance

- Check moving parts and housings in motors and gear boxes for hot spots.

Temperature change can indicate developing problems in many types of equipment, from ovens and boilers to freezers. Routine temperature audits of generators and their bearings can prevent expensive repairs. Scanning bearing temperatures with an infrared thermometer allows the maintenance engineer to detect hot spots and schedule repairs or replacements before the problem leads to an equipment failure.

Building controls

- Monitor HVAC/R components for quick energy audits and room balancing in a short time.

An IR thermometer with a 60:1 distance-to-spot ratio makes elevated vents and returns more accessible. For example, when a thermometer has a 10:1 distance to spot ratio, one can stand 10 inches away from the target and measure the temperature of a 1-in. circle. At 10 feet

away from the target, the measurement spot will be a 1-ft circle.

An IR thermometer can quickly survey compressor head temperatures, compressor oil sump temperatures, evaporator coil and suction line temperatures, discharge line temperatures, condenser coil and liquid line temperatures, and fan motor temperatures.

Insulation on all surfaces can be scanned for leakage and losses. Higher temperatures are indicated by a shift toward white. Lower temperatures are indicated by a shift toward black.

Process/product

- Monitor process lines. Check the temperature of different products on production lines.
- These can vary from rubber tires to plastic, from concrete to chocolate bars.

Best practices for IR temperature measurement

To get the best non-contact measurements, follow these guidelines:

- Get as close as safely possible to your target.
- When measuring at a distance, understand the size of the measured target based on the distance-to-spot ratio.
- When you often need to measure a reflective surface, mask the reflective target with flat black paint or tape for best results. This also helps ensure the same spot is measured every time.
- Consider reflected infrared radiation. Items that have shiny, reflective surfaces will reflect infrared energy from other objects, including the sun. This can interfere with measuring the target's radiated infrared energy.
- Experiment with several angles to get the best measurement. A better angle can often mitigate reflected energy from other infrared energy sources.
- Make emissivity adjustments to minimize measurement errors.
- Consider using a contact thermometer or a contact thermometer probe that plugs into your infrared thermometer to verify readings of which you are unsure. EB

— *Will files from Fluke Corp.*

The size of the temperature measurement area (a.k.a. the spot) increases with distance. Infrared thermometers with a higher distance-to-spot ratio (D:S) can take accurate measurements at a greater distances.

WHEN THE BANK SAYS *NO!*

Sources of non-traditional financing

In the business of investment banking, we are exposed to all kinds of difficult situations business owners face. Sometimes our client's need for financing is driven by an unexpected business or sector slowdown; other times it is for acquisition or growth purposes. But, more often than you might think, the need for capital will arise as a result of a breakdown of existing credit facilities through no real fault of the borrower.

"A business owner can have a longstanding relationship (along with shining credit rating and excellent margins) with a traditional lender, and still find his loan called, or no-brainer requests for further capital declined," says Barry O'Neill, managing partner and a founder of Zed Financial Partners. "Changing market conditions, concerns around exposure to industry sectors and risk management strategies can change a traditional lender's interest in a client... and the effects can be devastating."

However, an owner can go on the offensive and secure the liquidity he needs outside of traditional financing sources. Owners and managers must learn to become creative and well-versed in options for financing their businesses as they are in other facets of operations.

Sometimes it is a matter of looking for another financial institution that better understands the business. Other times, it requires re-examining the assets of a company from a different perspective.

Often, access to the appropriate financing may solve liquidity problems or even present hidden and creative opportunities for freeing up cash flow. Several unique structures may be employed to ensure a successful transaction and to maximize the availability of funds. Knowing where to find the different types of financing is crucial. Barry O'Neill suggests a few:

The U.S. option

An increasingly viable option for Canadian businesses is U.S. private equity and private debt lenders. There are a limited number of such sources of capital available in Canada but, in the States, there are hundreds of different institutions that are actively seeking opportunities in Canada. Because of the vast amounts of money available south of the border and a limited number of transactions, many of these financial institutions are looking for opportunities outside of the United States.

Because of the size and specialization of the American financing market, there are numerous funds that specialize in specific industries. Understanding industries allows them to better assess the risks and rewards associated with the financing, resulting in a better financial partner. As a result, there is growing demand for more creative financial structuring to solve liquidity issues. Companies seeking U.S. funding should work with financiers who understand the industry sector and business, so they can work with the company as it changes and grows.

Get creative

Regardless of whether the source of capital is domestic or foreign, the key to securing capital is presenting value where others don't, then translating that value

into a workable solution for a lender. There are many ways to put financing together; it's just a matter of being creative and knowing where the money is. Some examples of different vehicles for creative financing that we've secured through non-traditional sources include:

Equity or quasi-equity partners
A well-suited, strategic financial partner who understands the business and industry can provide the appropriate financial structure to take the company forward. These partners typically bring cash injections to relieve immediate problems and supply sufficient liquidity to take the company forward and, often, are critical to the future viability of a company. Private equity partners can be important tools in situations where owners want to retire or semi-retire, and transition the company to family or a management group, but wish to extract some wealth from the business.

Refinancing of subordinated debt
Subordinated debt may need to be restructured or refinanced to alleviate liquidity concerns. Strategies for accomplishing this objective include: purchasing the debt at a discount; converting debt to equity; exchanging the debt for future royalty payments tied to revenue or cash flow; moving the debt off-balance sheet.

Cash flow management
In many cases, significant capital is tied up in working capital. Various operational specialists can help assess cash flow restrictions and help companies unlock liquidity by putting in proper controls and systems.

Securing future cash flow streams
Cash flow streams that are associated with long-term contracts and a high degree of certainty may be sold to a third party.

Sale-leaseback
Land and/or buildings can be sold to certain lenders at market value or greater using long-term sale-leaseback agreements. In this case, the financier relies on the company's business plan and future cash flows to support future payments.

Refinancing 'depreciated' assets
Specific machinery and equipment within a company may have little or no collateral value to traditional lenders. Other lenders, such as appraisal or auction companies, may attach value to these assets that allow other financiers to loan against them, regardless of whether they have been fully depreciated.

Intangible assets
Many companies find that intangible assets (e.g. patents, trademarks) carry little or no collateral value to traditional lenders. However, some non-traditional lenders will lend against such assets. In fact, there are firms that will attach a value to intangible assets and guarantee that value to lenders.

Tax structures
Off-balance sheet structures may generate additional liquidity. For example, intellectual property may be sold into a separate company, which reverts back to the parent company after a period.

The bottom line
Accessing capital can be expensive, time-consuming and frustrating, but it need not be, as there are numerous options outside of traditional financing sources. One of the most important advantages in maximizing a company's access to capital is finding the most beneficial source of capital from the most ideal financial partner.

In many cases for Canadian businesses, banks and traditional sources of funding are the ideal financial partners. The convenience and efficiency of the commercial branch suit most situations effectively, and commercial bankers work hard to service their clients. However, they can also become impediments and obstacles.

There are countless ways to improve business liquidity, and it makes sense to review options regularly, before additional liquidity is needed. With all of the non-traditional financing sources available, a *No!* from your traditional lender might be a blessing in disguise. EB

Mark Borkowski is president of Mercantile Mergers & Acquisitions Corp. Visit www.mercantilemergersacquisitions.com.

Cooper Lighting Halo Commercial downlights

Cooper Lighting describes its new Halo Commercial line as a comprehensive Energy Star-qualified line of high-efficiency, high-quality recessed downlights. According to Cooper, the downlights yield over 70% optical efficiencies and feature a fully assembled and pre-wired "boat-shaped" housing frame with Halo's pre-installed No Fuss Bar Hanger system. The offering accepts compact fluorescent, metal halide, tungsten halogen and integrated LED lamping options.
COOPER LIGHTING
www.cooperlighting.com

Hubbell Lighting unveils updated website

Hubbell Lighting launched its new website, saying they've substantially improved the usability of the site while refreshing the look and feel with an updated, progressive design. New homepage banners are continually updated, emphasizing new products and applications, while the electronic Product Selection Guide (e-PSG) is integrated directly into the site. A new Retrofit Solutions microsite supports the retrofit market with product solutions for a range of applications, and the company says the new site also boasts improved Agent and Distributor locator tools.
HUBBELL LIGHTING
www.hubbelllighting.com

RC Lighting LFLED5 5W LED landscape light

RC Lighting has introduced its LFLED5, a 5W LED landscape light designed to replace small-scale landscape floodlights and

spotlights. Equivalent to a 35W MR16 fixture, the LFLED5 claims to deliver as much as 85% energy savings relative to existing halogen systems. The LFLED5 is cUL-listed for wet locations and sports a minimum starting temperature of -40°C.
RC LIGHTING
www.rclighting.ca

Bridgelux expands Decor LED Array series

Bridgelux has expanded its Decor 97 CRI product series, which was originally introduced in October 2011. The Decor series now offers increased efficiency as well as a broader range of light sources—from 500 to 5000 operational lumens in three colour temperatures, 2700, 3000 and 3500K. With a CRI of 97 and a 3-step MacAdam Ellipse colour control option, the company claims the arrays enable lighting designers to accurately render a full palette of colours over a wide range of light levels.
BRIDGELUX
www.bridgelux.com

American Illumination launches Integrated Series Light Plugz LED engines

EBMag was there as American Illumination unveiled the Integrated Series Light Plugz LED engines at Lightfair 2012 in Las Vegas, Nev. The series is customizable for retrofit lighting and various fixture designs, and use 1W to 6.3W Cree XP Series LEDS for both low and line voltage luminaires. The series is wet location listed and features field-interchangeable optics, intelligent thermal management, various connector options and, bezel and custom sizing.
AMERICAN ILLUMINATION
www.american-illumination.com

ADVERTISER INDEX

Kris Paszkowiak, P.Eng.

Ground fault protection versus detection

The 2012 Canadian Electrical Code (CEC, 22nd Edition) contains new definitions explaining ground fault, ground fault *protection* and ground fault *detection*.

Ground fault protection means detecting and interrupting a ground fault current at a level less than the current required to operate the circuit overcurrent device. The main purpose of ground fault protection is to protect electrical equipment from damage due to arcing faults in solidly grounded systems. This usually means a system where the transformer secondary neutral is directly connected to ground without any resistor or impedance device. The amount of current flow may be small under an arcing fault condition, as it is being limited by the resistance of the arc and may not be detected by a standard overcurrent device. This type of connection can cause extensive equipment damage.

CEC Rule 14-010 requires protective and control devices be provided to automatically open the electrical circuits in the event of a ground fault. The application requirements for such a protective device are detailed under Rule 14-102. Solidly grounded systems are required to have ground fault protection to de-energize all normally ungrounded conductors of a faulted circuit. For example, ground fault protection is required on systems such as 120/208V, 2000A or more and 600/347V, 1000A or more.

The rule also requires that the maximum setting of the ground fault relay pickup point be 1200A or less, and that it operate within 1 second for fault currents of 3000A or higher.

It is the largest fuse that can be installed in a disconnect switch, or the maximum circuit breaker setting, that are used to determine whether ground fault protection is required. The ultimate point of conductor de-energization is shown in Diagram 3 for various system arrangements.

CEC Rule 10-106(2) requires wiring systems supplied by an ungrounded supply to be equipped with a suitable ground fault detection device to indicate the presence of a ground fault. For example, ground fault detection devices are required on 600V, 3-phase, 3-wire, ungrounded delta-connected systems.

The main purpose of *ground fault detection* is to provide indication or an alarm that a ground fault has been detected in an ungrounded system. Ground fault detection devices detect a ground fault and provide an indication or alarm, or both. These monitoring devices do not necessarily control or interrupt ground fault current and are, therefore, not considered a form of ground fault protection.

Ground fault indicating lights are the minimum requirement because they require daily monitoring. It is important to understand what these lights indicate and to take appropriate action prior to the second fault occurring on the system. Locating a ground fault can be a lengthy and frustrating exercise, but necessary nonetheless. Arcing line-to-line faults can be very destructive and represent an electrical shock hazard.

The CEC contains other rules that mandate ground fault protection or detection, such as Rule 64-018(1)(e) Ungrounded renewable energy power systems. This rule requires all ungrounded systems to be provided with a ground fault protection device or system that detects a ground fault, provides indication and disconnection. Large renewable energy systems, such as wind systems consisting of one or more wind turbines with rated output exceeding 100kW, are required by rule 64-404(6) to have ground fault protection or detection. EB

Kris Paszkowiak is principal of CodeSafety Associates, a consulting firm serving the needs of the electrical industry. He holds a Master Electrician licence and has served numerous organizations over the years, including the Canadian Advisory Council on Electrical Safety, Committee on CE Code Part I and UL Electrical Council. E-mail CodeSafety Associates at kris.paszkowiak@codesafety.ca.

Questions and answers compiled by the Electrical Safety Authority | VISIT WWW.ESASAFE.COM

Tackle The Code Conundrum... if you dare!

Answers to this month's questions in August's Electrical Business.

How did you do with the last quiz? Are you a...

Master Electrician ? (3 of 3)
Journeyman ? (2 of 3)
Apprentice ? (1 of 3)
Plumber ?! (0 of 3)

Question 1

Utility interactive inverters are permitted to be mounted on roofs that are not readily accessible, provided that:

a) a DC and AC disconnecting means are provided either integral to the inverter or located within 9 m and sight of the equipment
b) AC disconnecting means is provided in an accessible location
c) a permanent and legible single line diagram in installed in a conspicuous location at the supply authority disconnecting means
d) all of the above

Question 2

Receptacles shall not be located within ____ of the inside walls of the pools:

a) 0.5 m **b)** 1.0 m **c)** 1.5 **d)** 3.0 m

Question 3

Bare conductors or insulated conductors not enclosed in grounded metal shall be used in electrical equipment rooms accessible only to authorized persons:

a) True **b)** False

Answers: EBMag June 2012

Q-1: All receptacles of CSA configuration 5-15R and 5-20R installed in childcare facility shall be tamper resistant receptacles, unless rendered inaccessible behind a stationary appliance.
b) False. Ref. Rule 26-700(12).

Q-2: Single phase inverters for utility interactive solar photovoltaic systems are permitted to be connected to 3-phase systems, provided they are:
d) All of the above. Ref Rule 64-112.

Q-3: Receptacles required for maintenance of rooftop HVAC equipment shall be:
c) Of CSA configuration 5-20R. Ref. Rule 26-704.

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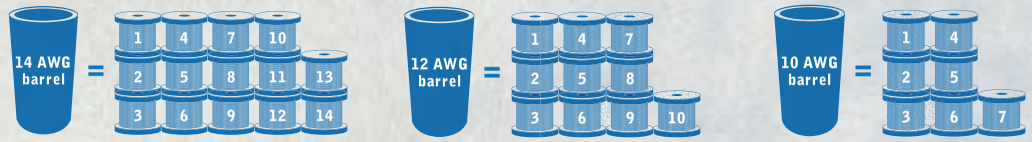

14 AWG barrel replaces 11-14 reels. 12 AWG barrel replaces 7-10 reels. 10 AWG barrel replaces 5-7 reels.

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