

Electrical Business

SEPTEMBER 2013



Get up to code.
See how on **Page 5.**

■ Also in this issue...

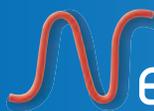
- Improving electrical safety for all Canadians
- Termination clauses de-mystified
- Transmission stability and infrared windows

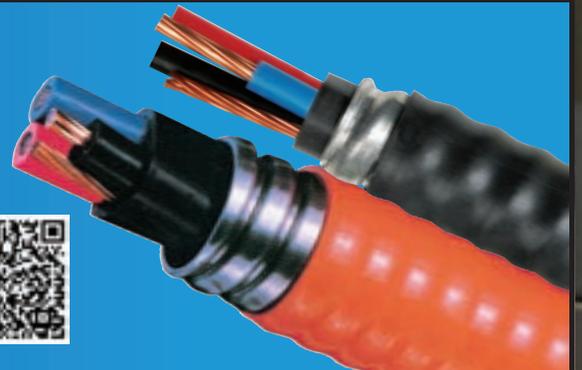
TOP 10 THINGS Not To Do when taking electrical measurements

PM # 40065710

FIREX® II
TECK90
CABLE
LEAD FREE & RoHS



 **nexans**
www.nexans.ca



IPEX NEW PRODUCTS FROM IPEX ELECTRICAL SYSTEMS

Universal F Series Double Gang Boxes and Covers



Scepter® F Series double gang boxes, weather-proof covers and cover plates have been redesigned for universal compatibility with any industry

standard double gang box or cover. CSA approved, the new universal boxes and covers are easy to use, have more internal wiring space and include reducer bushings to accommodate various sizes of conduit. All the weatherproof covers have been designed to ensure a watertight seal using a new foam gasket, with an adhesive layer for ease of installation.

Round Floor Box and Stand



Simple yet innovative, the new Round Floor Box Stand is designed to raise the Round Floor Box off the concrete form allowing the ENT or

conduit to enter the Box in a flat and straight path. Installed together, the Floor Box and Stand accommodates the different rebar and post-tensioned cable heights and slab depths found from job-site to job-site.

Sold as a kit, IPEX Electrical offers the Round Floor Box and Stand conveniently packaged together as one complete product offering.

SceptaCon Trenchless Raceway for Traffic Signal & Street Lighting



The new 2" SceptaCon is ideally suited for street lighting and traffic signal cables where installation requires a smaller diameter pipe than your

typical electrical raceway. Now contractors can install RW cables instead of the more expensive TECK cables required with the use of HDPE pipe.

**For more information call
Toll Free: 1-866-473-9462
or visit**

www.ipexelectrical.com

Products manufactured by IPEX Electrical Inc.

Kwikon® is a trademark of IPEX Branding Inc.



Dual Mounting System from Kwikon



Slab Box Installation Made Easy

Designed to withstand tough jobsite environments, Kwikon® ENT slab boxes are nonmetallic, nonconductive and noncorroding. All Deep Round Series slab boxes feature our new CORNER MOUNTING TABS. These uniquely positioned corner tabs allow contractors to easily nail Kwikon slab boxes to the slab deck. The angled design guides the nail to be positioned inside the fixture's trim cover, reducing the threat of visible rust bleeding through the finished ceiling.

- Approved for support of ceiling fans up to 35 lbs and luminaries up to 50 lbs
- Corner and traditional mounting tabs offer contractors two options when installing to the slab deck
- Angled design guides the nail into position within the trim cover area
- Ready to install – no assembly required

Toll Free: 866-473-9462 | www.ipexelectrical.com

Products are manufactured by IPEX Electrical Inc.



EPR Kit Adapters make Duct repairs quick & easy!



New Adapters for our EPR Conduit Repair Kits allow contractors to repair a broken section of DB-II duct while leaving the cables inside and restoring the duct to its original form. The

pre-cut adapters easily open around existing cabling to make repairs quickly and effectively, reducing end-user downtime and complaints, and saving contractors time, labour and money.

The Perfect Expansion Fitting for Short Runs!



The One Piece Expansion Joint (OPEJ) is designed to accommodate thermal expansion and contraction on shorter runs of PVC Conduit.

The efficient design of the One Piece Expansion Joint provides fast trouble-free installation and will ensure the owner receives a secure and appealing installation that will last the life of the system.



It is the industry's moral obligation to make it so, thereby distinguishing pros from the joes.

Separating the pros from the joes

Depending on your particular jurisdiction in Canada, there may be a score of hot-button issues involving the electrical industry, such as unlicensed and/or unqualified electrical contractors/electricians performing electrical work, counterfeit products, apprentice ratios, etc.

One issue that seems to rise above the noise—and that, in truth, encompasses all the others—is that of electrical safety for both electrical professionals and the general public. For example, as you'll see in our Letters section, a number of readers are concerned with unqualified electricians and/or unlicensed electrical contractors performing work in the market. Sure, one could argue this is not an issue of safety; that the only reason these readers are complaining is because *they paid their dues* while the others are getting a free pass. They're also taking work away from legitimate tradespersons to boot.

Both are valid complaints, but the persistence of these handymen in the market leads to issues of electrical safety and protecting human life and property.

This is why EBMag is such a strong follower and promoter of electrical safety information. Our stance is that working safely and producing safe electrical installations are not just good business, but the *noble and ethical things* to do. It is the industry's moral obligation to make it so, thereby distinguishing pros from the joes.

Like us, we want you to become more personally involved in the world of electrical safety, and there's an excellent opportunity to do just that at ESFi-Canada's 2013 Electrical Safety Summit, being held next month, October 28, at CSA Group's office at 5060 Spectrum Way, Suite 100, Mississauga, ON L4W 5N6.

You can read more about the inaugural summit in 2012 in this issue, as well as at EBMag.com. This year's summit promises to be just as engaging and inclusive, and includes two dedicated sessions (though you can register to attend both):

Session 1 boasts a focus on consumer safety, where experts will provide insights into the what counterfeit investigators are finding, the challenges of enforcement and the steps being taken to protect consumers. Session 2 focuses on workers; this is the session for you if you are involved in advancing worker safety and have an interest in defining opportunities to reduce electrical workplace incidents.

Visit www.esfi.ca to learn more, or contact ESFi-Canada's executive director, Cathy Chernysh, at cathy.chernysh@esfi.ca or (416) 219-0821. EBMag will again be covering this key event, and we hope to see you there. **EB**

Anthony Capkun



On the cover and page 20

Top 10 Things Not To Do when taking electrical measurements

Measuring live voltages and current in today's high-energy environments can result in a severe hazard to equipment and users when proper precautions are not applied. (Photo A. Capkun)

Contents

14 Improving electrical safety for all Canadians

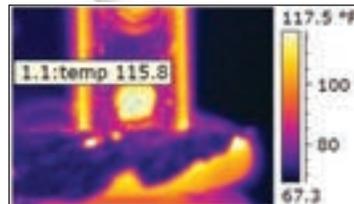
Electrical death and injury are devastating and highly preventable, and it is not just workers who suffer from electrical contact and fires caused by electricity—children and homeowners are also at risk.

16 Transmission stability and infrared windows

When using infrared (IR) windows or sight glasses, it is imperative to understand the accurate transmission rate of the optic used in the infrared window. Failure to accurately compensate for actual transmission attenuation can lead to significant errors in data.

22 New addressable fire system hits a home run for the Fisher Cats

The New Hampshire Fisher Cats—the Toronto Blue Jays' Double-A affiliate team—has hit a home run through the replacement of their stadium's old, damaged fire system with a new addressable fire system promising more robust surge protection.



DEPARTMENTS

- 4 Industry News
- 8 Personalities
- 9 Mind Your Safety
Maintenance-driven safety (Part 2 of 2)
- 10 Letters
- 24 From The Legal Desk
Termination clauses de-mystified
- 25 Calendar
- 26 Products & Solutions
- 30 Code File
Polarity identification for PV system conductors
- 30 Code Conundrum

page 28



Thanks to M. Koch of Quebec for pointing out a typo in my July 2013 Editor message, "The end (and beginning) of an era", on page 3. The final IED/Affiliated Distributors Canada annual general meeting was held in Charlevoix, La Malbaie region of Quebec, not La Balbaie.

— Ed.

Thanks to Tom B. of Nova Scotia for reminding me that CEMRA members, independent manufacturers' representatives, make up a significant portion of Electro-Federation Canada's Electrical Council membership, which I discussed in my August 2013 Editor message, "You have your own personal reporters", on page 3.

— Ed.

MAXIAMP®

CABLE BUS SYSTEM

The Most Technically Advanced Electrical Power Delivery System



- Free Air Ampacity Rating in ABOVE and BELOW GROUND Installations*
- Up to 8000 AMP / 600 V to 230 kV
- Reduced Power Losses
- Lowest Cost System
- Suppresses EMF's
- Expandable Enclosure
- Quick & Easy Installation
- Underwater Installations



*Patent Pending



Trefoil Cable Configuration.

Replaces BUS DUCT, ARMoured CABLE IN TRAY, UNDERGROUND DUCT BANK, DIRECT BURIED and CONDUIT SYSTEMS

United Wire & Cable's expertise in cable and enclosure design, manufacture and application engineering ensures a reliable, versatile and cost effective MAXIAMP cable bus system.

For further information please email us at: sales@unitedwc.com
Tel: (905) 771-0099 or 1-800-265-8697 • Fax: (905) 771-1658 or 1 800-461-4689

Going to great lengths to serve you

www.unitedwc.com



United Wire & Cable

Electrical Business

September 2013 • Volume 49 • Issue 9

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

Group 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

Marie Weiler - mweiler@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: mweiler@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: Marie Weiler
e-mail: mweiler@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.

The contents of *Electrical Business* are copyright ©2013 by Annex Publishing & Printing Inc. and may not be reproduced in whole or part without written consent. Annex Publishing & Printing Inc. disclaims any warranty as to the accuracy, completeness or currency of the contents of this publication and disclaims all liability in respect of the results of any action taken or not taken in reliance upon information in this publication.

We acknowledge the financial support of the Government of Canada through the Canada Periodical Fund of the Department of Canadian Heritage.



PV player Heraeus nails former employee for alleged trade secrets theft



Heraeus Precious Metals North America says it has obtained a \$500,000 judgment under an agreement reached in litigation with former Heraeus Materials Technology LLC employee, Tung Pham, concerning alleged trade secrets theft.

Pham was employed as a senior scientist for the Photovoltaics Business Unit in West Conshohocken, Pa. Shortly after his resignation in April 2011, Heraeus found evidence that Pham had taken “highly sensitive” company trade secrets, and altered or removed research data without permission relating to the development of a commercially viable lead-free metallization paste.

Heraeus says it took immediate steps to protect and recover its valuable information, including notifying and cooperating with the FBI and the U.S. Attorney’s office. As part of the settlement, Pham admitted he improperly downloaded hundreds of trade secrets and confidential information from Heraeus’ computers immediately before his resignation.

The Heraeus Photovoltaics Business Unit is a developer and manufacturer of silver metallization pastes (photo) for the photovoltaic industry.

CEA encouraged by Federation’s focus on investing in skills training

The Canadian Electricity Association (CEA, www.electricity.ca) says that, given the prominence of the discussion of the Canada Job Grant at the Council of the Federation meetings in Niagara-on-the-Lake, Ont., this week, it is encouraged by the focus on the issue of investing in skills training for Canadians.

“CEA is supportive of action on this important challenge,” said Jim Burpee, CEA president and CEO. “Because human resources challenges in the electricity sector are especially acute, we urge the federal government and the premiers to find a way forward that ensures the availability of skilled trades professionals for the electricity sector.”

The urgency to address a skilled labour shortage in Canada’s electricity sector is compounded by

the following:

- 40% of the current workforce in the electricity sector, or 45,000 employees, are set to retire between 2011 and 2016 (Source: Electricity Human Resources Canada, www.electricityhr.ca).
- The need for additional workers to undertake the renewal of Canada’s electricity infrastructure, estimated by the Conference Board of Canada to require 156,000 jobs each year over the next 20 years.
- The need for the next generation of electricity sector workers to possess new skill sets to support the integration of new and innovative technologies.

“We are supportive of programs

that have enough flexibility in design and in the definitions of what constitutes training to ensure electricity-sector apprentices and participating utilities can benefit,” added Burpee. “Ours is a highly-regulated industry and the prominent role of provincial regulators in workforce planning must inform discussions with provinces.”

Solutions for residential construction.

Stop building extra supports on site and still meet code requirements.

Support solution between two studs

Bracket fits range of applications

Quick and easy to install

The new **Iberville® BCBK-01** adjustable wood stud support bracket allows installers to meet C.E.C. code requirements (**12-3010**) quickly and efficiently while eliminating the need to build extra supports on site.

- Use with welded boxes more than 4 inches wide or ganged sectional boxes
- Easily adjusts to any drywall thickness from ½ inch to 2 x 5/8 inch
- For use with 2x4-inch or 2x3-inch wood studs
- Embossed guides adjust the bracket for any box depth
- Ideal solution to support boxes between two wood studs
- CSA Certified
- Designed and manufactured in Canada

Check out our installation video at www.tnb.ca/video.

Thomas & Betts. Your best connection for innovative solutions.

Wire & Cable Management • Cable Protection Systems • Power Connection & Control • Safety Technology

www.tnb.ca

Thomas & Betts
A Member of the ABB Group



Jenni Becker

Join Empire Level in the fight against counterfeiters

Empire Level (empirelevel.com) says it is working aggressively to stop the counterfeiting of its torpedo level, aiming to block imported knock-offs at the U.S. border and pushing for the removal of the counterfeit products from store shelves to ensure they do not end up in the hands of consumers.

“Empire Level was built on innovation

and hard work by many people, starting with my great-great-grandfather when he came to America for a better life, and I’m determined to protect the company from any threats to those American ideals,” said Jenni Becker, president of Empire Level.

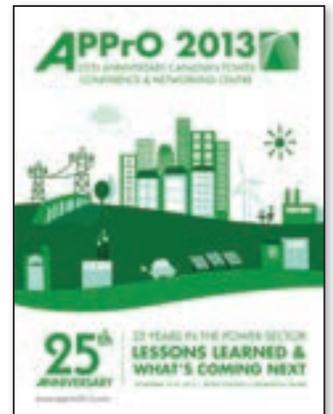
The family-owned company says it has issued dozens of cease-and-desist letters to Chinese suppliers—as well as U.S. distributors and retailers—dealing in the

counterfeits. In recent months, tens of thousands of the knock-off units have been taken off the market with related advertisements stopped, says Empire, adding it has launched more than 100 enforcement efforts—including more than one with major retailers—resulting in quick settlements.

According to the U.S. Department of Customs and Border Protection, notes Empire, China remains the world leader in the production of counterfeit merchandise, with 72% of all fake goods originating from that country. The company adds that the Organization for Economic Cooperation and Development reports criminal networks and organized crime negatively affect nearly every product category, stealing market share and undermining innovation.

“We strongly encourage all retailers, as well as our fellow manufacturers, to do what we’re doing and fight back to discourage unscrupulous suppliers and sellers—both foreign and domestic,” advised Becker.

APPrO! 25th anniversary Canadian Power Conference & Networking Centre



November 19-20, 2013, mark the 25th anniversary of the Canadian Power Conference & Networking Centre (a.k.a. APPrO, conference. appro.org/conference2013), located in Toronto, Ont.

APPrO 2013 organizers hope you’ll join in on the preparation as well as the festivities. For example, APPrO is sponsoring the Power Memory Project (on fb.me/17WgcF8) on Facebook, where you are invited to post your photos, anecdotes, videos and any “tidbit that is important to you or to your company from any point in time over the past 25 years”. A selection will be compiled and broadcast at the 25th anniversary banquet dinner.

Organizers are also reaching out via Twitter, saying they want to

FLIR®

FLIR E-Series Cameras

Lowest Cost... EVER.

SPECIAL LIMITED TIME OFFER!
July 25 - September 30, 2013

Purchase a new FLIR E-Series thermography camera between July 25 and September 30, 2013 and get a rebate up to \$400 in the form of a MasterCard Gift Card.

FLIR E30 \$2795*	Receive a \$200 MasterCard Gift Card	FLIR E40 \$3845*	Receive a \$250 MasterCard Gift Card
FLIR E50 \$5695*	Receive a \$300 MasterCard Gift Card	FLIR E60 \$7595*	Receive a \$400 MasterCard Gift Card

Get details on all the high performance thermal imaging you ever desired at www.flir.ca or call 1-800-613-0507 x24 / x25 today.

FLIR®
Quality - Innovation - Trust

*After factory rebate. Buy your choice of one of the following new FLIR Thermography cameras: E30, E40, E50 or an E60 from FLIR Systems Canada, its affiliates, or an authorized distributor or representative between July 25, 2013 and September 30, 2013. See Promotion Terms, Conditions, Limitations and Exclusions for additional requirements and other important information. Images/content are for illustration purposes only.

hear your ideas and suggestions for the kind of event you'd like to attend. To share your ideas, or if you'd like to join the Programming Committee, Tweet to @APPPrOntario #APPPrO2013.

Fort Mac West Transmission Project moving to Competitive Process

The Alberta Electric System Operator (AESO, www.aeso.ca) is moving into the next stage of selecting a successful proponent for the Fort McMurray West 500kV Transmission Project, adding it will be the first project in Alberta to use the Competitive Process (www.aeso.ca/cp).

"We've had 30 organizations indicate they are interested in the next phase of the process, the Request for Qualifications (RFQ) stage," said Elizabeth Moore, director of the Competitive Process. "It's been very gratifying to have companies from across Alberta, all over Canada and around the world, express interest in the project."

The RFQ stage will conclude in December 2013 when an AESO-selected panel of experts will shortlist up to five bidders to move to the Request for Proposals (RFP) stage. AESO expects a winning proponent will be named by the end of 2014.

"At the end of the day, the proponent who can deliver the project at the lowest cost, while ensuring high quality and meeting all industry standards in construction, safety and ongoing operations maintenance will be identified and awarded the opportunity to develop, design, build, finance, own, operate and maintain this major transmission facility," added Moore.

The Fort McMurray West 500kV Transmission Project is needed to support continued oil sands growth, says AESO. It will consist of about 500 kilometres of transmission line and associated facilities between the Edmonton and Fort McMurray regions, and is expected to be in service by 2019.

A second competition for the Fort McMurray East 500kV Transmission Project is expected to commence in 2015/2016.

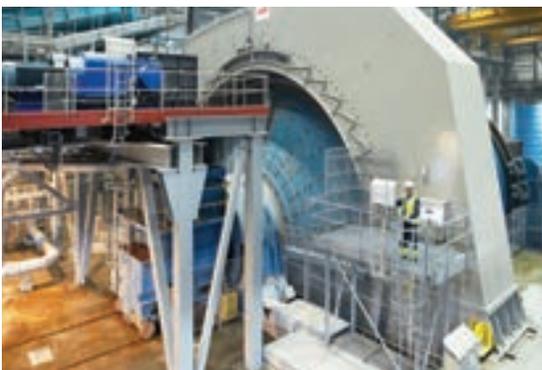


ABB acquires ring motor business from Alstom

ABB (www.abb.com) has acquired Alstom's ring motor business, saying the deal will enhance its gearless mill drive (GMD) system business. Financial details of the transaction were not disclosed.

Based in Bilbao, Spain, the business has about 120 employees and will become part of ABB's Process Automation division. Regarding the deal, Alstom (www.alstom.com) says it has decided to concentrate its Bilbao site on activities directly related to hydropower, thereby refocusing "on its core activities and be ready for further opportunities". As part of the agreement with ABB, Alstom will relocate these activities to another site in Bilbao.

ABB explains GMD systems are used in the mining industry for processing large quantities of ore to extract metals such as copper, gold, platinum, iron and molybdenum. The market for these systems is expected to grow, adds the company, due to rising demand for minerals in emerging countries undergoing industrialization. Deeper mines with more complex ore bodies and lower ore grades require the grinding of increased amounts of material to yield

the same volumes of metal. GMD systems are designed to address the need for extremely high ore throughput, reliability and availability of the grinding circuit, adds ABB.

"The acquisition will combine the leading ring motor product from Alstom with ABB's electrical offering for GMD systems, enabling ABB to enhance its position as a strong vertically integrated systems provider," said Veli-Matti Reinikka, head of ABB's Process Automation division. "The acquired expertise and market strength will provide new opportunities for growth."

The GMD eliminates all mechanical components of a conventional mill drive system, explains ABB; by mounting the rotor poles directly onto the mill, the mill itself becomes the rotor of the gearless motor. The gearless motor—also called wraparound or ring motor—is a very large synchronous machine that uses power electronics and a magnetic field to control the speed of the motor rotation. With no mechanical interaction between the stationary and rotating parts, there is a significant reduction in the amount of energy used, fewer parts and higher reliability, concludes ABB.

Canadian manufacturer specializing in
AC90 (Cu & Al) ACWU90, TECK90, NMD90

The Armoured Cable Specialists

northern cables

I N C O R P O R A T E D

P.O. Box 1564, 50 California Avenue, Brockville, ON K6V 6E6
Tel: 613.345.1594 Fax: 613.345.3147 Toll Free: 1.888.524.5050

getwired.
www.northerncables.com



On July 1st 2011, Bemag Transformer became part of the **Pioneer Power Solutions** family (OTC symbol "PPSI"). This group also owns **Jefferson Electric** and **Pioneer Transformers**. By combining these three companies, Pioneer is able to offer dry and liquid cooled distribution and power transformers for the North American electrical market.



The Bemag manufacturing plant in Farnham Quebec will undergo major changes. 15 000 square feet are being added to facilitate the manufacturing of medium and power units.



► **BEMAG TRANSFORMERS OFFERS:**

- Power transformers
- Medium voltage transformers
- Isolation transformers
- Transformers for non-linear loads
- Autotransformers
- Line reactors starting at 45 Hp

EB industry news

BC Hydro to offer smart meter OPT-OUT options for customers

Bill Bennett, British Columbia's minister of energy and mines, said BC Hydro (www.bchydro.com/smartmeters) will offer new options for customers who have put their smart meters on hold.

"Smart meters are now part of our standard operating equipment, just like utility poles and wires," said BC Hydro CEO Charles Reid (photo). "We have been engaging with customers throughout the province about smart meters over the past two years and we believe this solution is a reasonable compromise."

The government is responding to public concerns, it says, by providing opt-out options with the costs borne by those customers, and not subsidized by the majority who have a standard BC Hydro smart meter. BC Hydro customers who do not currently have a smart



Charles Reid

meter now have three choices:

- Choose the standard smart meter at no cost.
- Accept a digital meter with the radio Off. This option will be subject to a one-time cost to modify the meter, plus a monthly fee to read the meter.
- Keep the old analogue meter, which will be subject to a monthly fee that will include both the extra cost of reading

the meter and the cost of instituting duplicate systems.

"As we have said, nobody will be forced to take a smart meter. I believe that this is a fair and reasonable solution for all British Columbians," said Bennett.

Costs and fees associated with the options will be established by BC Hydro, but will be reviewed by the BC Utilities Commission (www.bcuc.com) to ensure the utility is only recovering the cost of providing and servicing the radio Off and analogue options. **EB**

EB personalities

Thanks to Electro-Federation Canada (EFC) for letting us know that **Chris Scott**, formerly vice-president of AD Canada (www.adrewards.ca), is now vice-president sales & marketing for **Northern Cables** (www.northerncables.com). "Chris will be responsible for increasing market penetration with strategic distributor partners and development of the Northern Cables brand in both Canadian and U.S. markets," explained company president, **Shelley Bacon**. "He will work with our current sales managers and reps to maintain current business, and identify and cultivate target accounts and opportunities." He can be contacted at cscott@northerncables.com or (905) 802-3428.

Canada/Western U.S. regional sales director. Prior to joining ETi, Highgate's career path included positions as director of LED for PennWell/The LED Show, director of sales & marketing for The Lighting Group, and area sales representative for Holophane. He also currently holds the office of district chair West Coast for the Illuminating Engineering Society (IES). ETi Solid State Lighting is a wholly owned subsidiary of Elec-Tech International Co. In addition to the ETi brand name and private label products, ETi has the rights to develop, manufacture, market, distribute and sell LED lighting under the Whirlpool brand, which will be sold at retailers throughout Canada and the U.S.

LED Roadway Lighting Ltd. (LRL, www.ledroadwaylighting.com) executive vice-president



Sean Yacoub



Jeff Bacon

Denis Lavoie announced the appointment of **Sean Yacoub** as territory sales representative for Ontario. Sean possesses over 16 years of sales experience, says LRL, most recently serving as sales manager for the ornamental street lighting and transmission & distribution markets with Stresscrete/King Luminaire. **Jeff Bacon** has also been appointed to the position of Canadian sales manager. He began his career with LRL

in 2007 as a sales engineer; later, he expanded his role to include outside sales activities within the Canadian market.

ETi Solid State Lighting Inc. (www.etiled.us) has hired **James Highgate** as its Western

Three Canadians are have elected to the **Power Transmission Distributors Association** (PTDA, www.ptda.org) 2013 board and Manufacturer Council. Sitting on the 2013 PTDA board of directors is immediate past president **Mitch Bouchard**, secretary treasurer of General Bearing Service in Ottawa, Ont. Acting as director is **Ajay Bajaj**, president of Rotator Products of Woodbridge, Ont. Meanwhile, joining the Manufacturer Council is **Sean Hickey**, president of Lafert North America in Mississauga, Ont. Founded in 1960, PTDA is an association for the industrial power transmission/motion control (PT/MC) distribution channel, representing 171 distribution firms and span 3,400 locations in Canada, the United States and eight other countries.

Markus Tacke has been appointed CEO of **Siemens Energy Sector's** Wind Power Division (www.energy.siemens.com). The 48-year-old Tacke will take the helm August



Markus Tacke

1, 2013. He succeeds **Felix Ferlemann** who, at 53, is leaving the company by mutual agreement to pursue new career challenges. Until now, Tacke has been CEO of the Energy Sector's Industrial Power Business Unit, responsible for Siemens' industrial power generation business worldwide. Before that, he had been responsible for the worldwide business of Siemens in industrial steam turbines. "Felix Ferlemann provided essential stimuli, and we thank him for his commitment," said **Michael Süß**, member of the managing board of Siemens AG and CEO of Siemens' Energy Sector. Ferlemann had been active at Siemens Wind Power since October 2011.

Staco Energy Products Company (www.stacoenergy.com) has announced **Dan Hinkle** as its new VP of Service. In this newly created position, Hinkle is responsible for supporting all customers in the field, and reports directly to Staco president **Jeff Hoffman**. "His vast experience developing and implementing service plans for large organizations will benefit Staco, our sales and service channel partners, but most importantly the many customers that we serve," said Hoffman. **Sam Sembhi**, who formerly handled service and quality initiatives at Staco, will continue to serve the company as the quality assurance manager.

Gregory J. Lampert will assume responsibility for all of **General Cable's** operations (www.generalcable.com) in the Americas, which includes Canada, the United States, Mexico, the Caribbean as well as Central/South America. "I have worked closely with Greg over the last 15 years. He has an in-depth knowledge of our major product lines and functional disciplines. As a member of the Global Operating Committee for the last five years, Greg has helped set strategy and played a key role in the acquisition and integration of Alcan Cable North America and Prestolite Wire," said **Gregory B. Kenny**, General Cable president and CEO. Lampert joined the company in 1998 and has held various leadership roles. He has served as executive vice president, president and CEO for General Cable North America since 2008 and is a member of the company's Global Operating Committee.



Eric Perrault

EBMag (www.ebmag.com) is pleased to announce that **Eric Perrault** has been retained as our new account manager for Quebec. Eric has a wealth of publishing and media sales experience and is a welcome addition to our *L'industrie électrique* team (www.ebmag.com/lindustrie-electrique.html). Please contact Eric for all of your advertising needs at eperrault@annexweb.com. **EB**



Maintenance-driven safety

Part 2 of 2

In our personal lives, most of us run our household systems to failure: appliances, furnaces, etc., as well as our vehicles, but one vehicle system we do not allow to run to complete failure is braking. Previous generations ran them so regularly to failure, causing so many deaths, that car manufacturers started putting in a wear bar that begins to squeal when the brake pads are worn to that point.

In addition, our dashboards are full of lights warning us of impending doom, with more added yearly. As vehicle owners, we cannot take credit for being on top of our brake maintenance; Detroit has ensured the squeal is so bad that anyone will notice impending failure before the vehicle kills someone.

None of us would want a vehicle without sensors for low oil or high temperature. In industry, some expensive and/or critical apparatus have onboard sensors detecting such things as bearing, oil and winding temperature, but most equipment has to be tested to determine its health.

We recently opened the back of some switchgear with a termination that had heated so badly it bulged the case of the PCB-filled capacitor above it. With some bad luck, that could have led to a failure and PCB infiltration shutting down a plant of several thousand workers.

In the same way that Detroit has taken the decision for brake changes away from the vehicle owner, a similar path is being set for equipment owners.

As our team was writing CSA Z463, we were all cognizant that running inexpensive, easily replaced, non-critical equipment to failure is a perfectly valid maintenance activity. Other equipment is well serviced by a regular preventive maintenance combination of cleaning and lubricating. There is, however, a great deal of equipment that requires predictive maintenance, which is the application of specialized tests to produce results that—when deciphered—help you determine the best course of action. This knowledge merges into the concept of condition-based maintenance. When these activities are preceded by a Failure Mode Effects and Criticality Analysis, the resulting process is described as reliability-centred maintenance.

The CSA Z463 team was aware we were creating a document that would make some people feel we were "telling them what to do", but this is incorrect. In CSA lexicon, a Guideline is merely that: a guideline. It is not a standard. In this guideline—to the best of our combined ability—we have addressed a broad range of equipment from many industries, and provided the owner with a recipe of tests that can be used to diagnose the health

of the equipment. One of the great unknowns is "How often?", and we have provided guidance on that question, too.

But be warned: five years ago, no Canadian safety standard existed that could be used to judge a company's actions (or inactions) leading up to an electrical injury or fatality. At some future time, the CSA Z463 guideline will become the CSA Z463 *standard*.

It is not black-and-white whether the death of a worker caused by a definite lack of maintenance will lead to a criminal code charge or conviction.

Check this out from the Criminal Code of Canada:

219. (1) Every one is criminally negligent who

- (a) in doing anything, or
- (b) in omitting to do anything that it is his duty to do,

shows wanton or reckless disregard for the lives or safety of other persons.

Legal experts with whom I've discussed these matters tell me the law is subject to interpretation. It is not black-and-white whether the death of a worker caused by a definite lack of maintenance will lead to a criminal code charge or conviction, but do you want to take that chance.

The best way to win a court case is to never go to court in the first place. Were a company to adopt CSA Z463 into its electrical maintenance best practices, not only would they glean the huge financial reward of doing so, they would also benefit from a safer workplace. Should an unfortunate incident occur, the company can rest a little easier, knowing it fulfilled its legal and moral duties. **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.

Selection of conductors: do we have a problem?

Apparently, we do, and there are numerous bits of information published on this subject that create further confusion. One such piece is published in May 2013 of this journal (EBMag pg 26 “Code File”), which explains alternatives to the application of Rule 4-006 by using correction factors of Section 4. This article also states that the ESA “Bulletin 4-12 permits and clarifies this alternative approach” to Rule 4-006.

As a former regulator who used to publish clarification Bulletins for the jurisdiction in which I was authorized to administer the Canadian Electrical Code (CEC) adopted for a regulatory purpose, I have come to appreciate that any clarification Bulletin should not change the legally adopted requirements of the code, but provide an interpretation of the requirements.

As far as I’m aware, Rule 4-006 had not been revised when it was adopted for use in the Province of Ontario, so a discussion of the alternatives by an AHJ (authority having jurisdiction) to a very clearly spelled out Rule 4-006 (which does not provide for such alternatives) appears to be highly questionable. In fact, the reference to the NEC in this regard could be questionable, as well; while NEC Article 110.14 allows for the use of “conductors with temperature ratings higher than specified for terminations” under particular conditions, such a provision does not exist in CEC Rule 4-006.

From a technical perspective, the use of correction factors in tables 5A, B, C or D as stated in the article appears to be questionable, too, as not one of these tables has any relation to the requirements of Rule 4-006.

Let’s concentrate on Rule 4-006: why was the CEC change made in this regard? To clearly follow the sequence of events, we need to unearth a few relevant bits of history.

History lesson

A number of years ago, the NEC/CEC Ampacity Task Force was established to conduct a thorough review of the ampacity values of NEC Tables 310.16 and 310.17, and CEC Tables 1-4, then harmonize these values in both codes. This assignment was based on a need to recalculate the ampacities used in both codes in accordance with objective scientific formula, and to facilitate necessary changes to both codes that would prevent excess of the maximum allowable operating temperature at any connected termination.

Many pieces of electrical equipment (e.g. fused switches, circuit breakers, panelboards, etc.) have been tested, marked and certified to the harmonized bi-national UL/CSA product standards based on the maximum permitted operating temperature at 75C. This fact has been captured in NEC for quite some time. Article 110.14 mandates temperature limitations at such termination, and requires the use of conductors sized on the ampacity values in the 75C column of Tables 310.16 and 310.17.

CEC had no similar requirement until the 2012 edition, as the previous values of ampacity Tables were more conservative than NEC’s,

code file

Nancy Hanna, P.Eng.

Rule 4-006 and the application of correction factors

In my last column (“CEC Rule 4-006 and CSA product standards”, EBMag March 2013), we compared Rule 4-006 with the requirements under several product standards and focused on two issues: referencing Tables 1 and 3 in Subrule (1) and specifying 90C as a default when the equipment is not marked (Sideris [2]).

(It is worth noting that when using ampacities based on Tables 1 or 3 as permitted by the rule, ensure limiting the ampacities to 75C for temperature-sensitive equipment.)

Continuing our discussion on Rule 4-006 “Temperature limitations”, let’s analyze it in relation to the application of correction factors. Rule 4-006 does not prevent the use of conductors having a temperature rating (e.g. 90C) in excess of the equipment termination temperature (e.g. 75C), but it does require such conductors to have their installed ampacities limited to the equipment termination temperature (e.g. 75C). Hold on to that fact, as we dig into how to apply correction factors.

Let’s consider a typical scenario where conductors with an insulation temperature rating of 90C are terminating on equipment with a termination temperature rating of 75C, and there is a need to apply correction factors (Tables 5A, B, C or D) to these conductors. The stringent approach is to apply the correction factors to the 75C ampacity of the conductor. However, there is an alternative, relaxed approach that can be considered.

In Ontario, Bulletin 4-12 permits and clarifies this alternative approach; it permits applying the correction factors to the

90C ampacity of the conductor with the condition that the corrected ampacity is less than or equal to the 75C ampacity of the conductor. This approach complies with the intent of CEC Rule 4-006 and harmonizes with the NEC.

Therefore, when correction factors are applied to 90C-rated conductors terminating on equipment with a termination temperature rating of 75C, the installed ampacity of such conductors shall be the lesser of:

- the corrected 90C ampacity (e.g. Table 5C factors x 90C ampacity column of Table 2)
- the conductor 75C ampacity (e.g. 75C ampacity column of Table 2)

The rationale for this approach is that equipment marked with a termination temperature rating is tested with conductors rated at that temperature. When the installed ampacity of the conductor used does not exceed that with which the equipment is tested, there will be no impact on the ability to dissipate heat from the termination.

Let’s look at the numerical example shown in Figure 1:

- correction factor is 0.8 (Rule 4-004 and Table 5C for 6 conductors)
- ampacity of #8 AWG copper 90C conductor 115 A (Table 2, 90C column)
- the 90C corrected ampacity is 115 x 0.8 = 92A
- compare the conductor ampacity at 75C with the 90C corrected ampacity
- the conductor installed ampacity is 92A.

Compliance with Rule 4-006 is based on the fact that the 90C corrected ampacity (92A) is less than 75C ampacity of the conductor (100A).

Note that when correction factors are applied to the 75C ampacity as per the stringent approach, the installed ampacity would be 80A (0.8 x 100A); the conductor size will then need to be larger to comply, or the overcurrent device will need to be changed. [E]

Nancy Hanna, P.Eng., is the engineering manager for Code & Standards Department at Electrical Safety Authority (ESA) where, among other things, she participates in the development of policies, guidelines and technical communication concerning code interpretation and consistency issues. She is a LEED Accredited Professional, and is a member of several CSA TCs for CEC Part 1, including Sections 24, 32, 46, 50 and 64. Nancy can be reached at nancy.hanna@electricalsafety.on.ca.

and no temperature limitations at conductors terminations were deemed to be necessary. Therefore, CEC users have been routinely selecting conductor sizes based on the 90C column from Tables 1-4 for termination on the equipment that is marked for the temperature restrictions up to 75C.

However, after the assignment to correlate ampacity values was completed by the task force, all values of Table 310.15(B)(16) (formerly Table 310.16) and 310.15(B)(17) (formerly Table 310.17) and CEC Tables 1-4 were harmonized. The result of such harmonization is seen in both codes: NEC 2011 and CEC 2012 have absolutely identical ampacity values in their respective Tables.

If we now compare the ampacities values between the CEC 2009 and 2012 editions, we’ll see that, in the 2012 edition, these ampacities (particularly in 90C column of Tables 1-4) have been significantly raised. It is obvious the restrictions mandated by Article 110.14 have to be reflected in Canada’s code to prevent unsafe operating temperatures at the point of termination of the conductors to the equipment that is marked with the temperature limitation.

New CEC Rule 4-006 states this requirement as follows:

4-006 Temperature limitations (see Appendix B)

- (1) Where equipment is marked with a maximum conductor termination temperature, the maximum allowable ampacity of the conductor shall be based on the corresponding temperature column from Table 1, 2, 3, or 4.
- (2) Where equipment is not marked with a maximum conductor termination temperature, 90C shall be used by default.

Appendix B Note on this Rule provides additional clarification on this requirement:

Appendix B Note on Rule 4-006

The intent of this Rule is to correlate the temperature rating of conductors where the ampacity is selected from Tables 1-4 with the lowest temperature rating of electrical equipment or any wire connector (terminal connector, lug, etc.). It is intended by this Rule that the

ampacity of conductors be selected from the temperature column in Table 1, 2, 3, or 4 that corresponds to the temperature rating marked on the electrical equipment. As an example, where a conductor is terminated on a breaker with a 75C rating, the maximum conductor ampacity would be based on the 75C column of the Tables. It should be noted that the temperature rating of a wire connector (terminal connector, lug, etc.) that is connected to the equipment may be higher than that of the equipment itself; it is the equipment rating that determines the conductor size, not the lug.

So based on the requirement of Rule 4-006 and on the clarification Note on this Rule, it is clear the conductor ampacity should be selected from the temperature column that is consistent with the maximum allowable operating temperature of equipment to which that conductor is to be terminated.

But what if an RW90 conductor is readily available, and a contractor intends to use it? Could we use the ampacity value from the 90C column and apply some de-rating factors from Tables 5A-5C? From discussions on this issue between designers, electrical contractors and regulators, it appears there is some confusion in relation to this particular point.

Nobody would argue that a typical RW90 conductor could not be selected, but the ampacity of this conductor would now have to be selected from 75C column of Tables 1-4. So, why can’t we select ampacity for an RW90 conductor from the 90C column of a respective ampacity Table and apply one of the correction factors of Tables 5A-5C?

Correction factors from Tables 5A, 5B and 5C are intended only for the allowable ampacity values obtained from Tables 1, 2, 3 and 4. It should be noted that for equipment with a conductor termination rating of 75C, Rule 4-006 requires the allowable ampacities to be based (i.e. obtained) on the 75C column of Tables 1, 2, 3 or 4. The Rule does not permit basing the allowable ampacity on any other value other than the value obtained from the 75C column for equipment with a required conductor termination rating of 75C.

The rationale for Rule 4-006 was to recognize how the equipment was tested during the certification process. Were we to review CSA C22.2 No. 4, No. 5, No. 29 and No. 244, we would find that all require the conductor used during the temperature testing to be based on a 75C ampacity.

The maximum allowable operating temperature of any circuit should be always limited to the lowest permissible value of such temperature for any component of the circuit. In a practical sense, a conductor ampacity is the operating temperature for a conductor that is fully loaded to the applicable values in Tables 1, 2, 3 and 4, and this ampacity would be equal to the temperature rating of the conductor.

For example, were 4X350kcmil copper conductors rated at 75C installed in four raceways at an ambient temperature of 30C and loaded to 1200A, the operating temperature



WORK ORDER



“Keeping a business profitable is hard work. The Sprinter makes it easier.”



“I started at MC Electrique as an electrician, so I know how important a van is to the demands of our business. That’s why when we were looking to upgrade our fleet, we needed a van that lowered our operating costs and had the most room to allow us to carry all the tools and equipment we



would need. One look at the Sprinter and we were sold. The diesel engine is incredibly quiet and fuel efficient, saving us money and lowering our operating costs. We also learned that the BlueTEC diesel technology produces less CO₂ emissions, so we knew our decision was a green one. And because it’s a Mercedes-Benz, we know it’ll be running strong with us for many more years to come.”

This is my business. This is my Sprinter.

“Because we can fit so much equipment in the Sprinter, we can easily offer 24-hour emergency service.”



For more stories like David Paré’s, visit MYSPRINTER.CA.



Mercedes-Benz

of these conductor would be 75C. Were we to select the 90C-rated conductor for the same example, the operating temperature of the conductor would be also 75C.

Were 3X#3 RW90 conductors in a raceway loaded to 115A in accordance with CEC Table 2, then such conductor loading would result in a conductor

operating temperature of 90C. When the number of #3 RW90 conductors is increased (let's say to eight conductors), Table 5C would require a correction factor of 0.7. In this case, $115A \times 0.7 = 80.5A$. Therefore, each of these 8X#3 RW90 conductors loaded to 80.5A will, again, operate at the temperature of 90C.

To limit the operating temperature of the conductor to 75C (the maximum allowable temperature rating of the equipment), the ampacity would need to be selected from the 75C column, then the correction factor of Table 5C should be applied to the selected ampacity. In the example of 8x#3 RW90 conductors

in the raceway (from the 75C column of Table 2 and from Table 5C) $100A \times 0.7 = 70A$. Therefore, each of these 8X#3 RW90 conductors loaded to 70A will, again, operate at the temperature of 75C.

The main issue here is the effect the conductor's operating temperature has on the equipment to which it is connected. The conductor can handle the ampacity, but the equipment was not tested with terminations above 75C. In addition to the discussion above, were the selected 3X#3AWG RW90 conductors terminated at the equipment rated at 75C, and they are operating in the ambient temperature exceeding 30C, then the appropriate de-rating factor of Table 5A should be applied to the ampacity already selected from the 75C column.

Were the ambient temperature is 40C, then 100A ampacity must be multiplied by the correction factor 0.91 from Table 5A, as the actual conductor used in this example is RW90 (and not RW75). Therefore, each of these 3X#3 RW90 conductors would be now loaded to $100A \times 0.91 = 91A$, and these RW90 conductors will, again, operate at the temperature of 75C.

Of course, regardless which correction factors are used for the selected ampacities, the resulting (decreased) ampacity of conductor should be checked for compliance with Rule 8-104 to ensure it is not less than 125% of the calculated load.

Unless Rule 4-006 is revised so as to allow for some alternatives, compliance with this Rule should be consistently applied by all CEC users. **EB**

— Ark Tsisserev has been an electrical safety regulator for more than 25 years, and has retired from the city of Vancouver as chief electrical inspector. Ark is a past-president of the Canadian Section of LAEI (International Association of Electrical Inspectors), and a registered professional engineer with a Master's degree in electrical engineering. He currently chairs the Technical Committee for the Canadian Electrical Code and represents CEC on the CMP-1 of the U.S. NEC. He is the electrical discipline leader and one of the principals with Stantec, and can be reached at ark.tsisserev@stantec.com.



“An energy audit helped us identify opportunities to save money by reducing electricity use.”

Mike Bannon,
VP of Production, Tempo Plastics

saveonenergy™
FOR BUSINESS

Saving energy makes sense – business sense.

Get up to 70% off project costs, including:

- Engineering studies
- On-site energy manager
- Key system upgrades
- Monitoring and targeting

Energy efficiency incentives from your local electric utility are available for **manufacturing operations** like yours. Whether you're in the **plastics and packaging, automotive or food and beverage industry**, you may be covered for up to 70% of your project costs, including engineering studies and process and systems upgrades to help lower operating costs.

Big or small, every Ontario business can benefit from energy efficiency.

Contact your local electric utility or visit saveonenergy.ca/industrial



Subject to additional terms and conditions found at saveonenergy.ca. Subject to change without notice. A mark of the Province of Ontario protected under Canadian trade-mark law. Used under licence. TMOfficial Marks of the Ontario Power Authority.



GOOD BUSY:

All you can think about is your company's potential.

BUSY:

All you can think about is your company's cash flow.



Use your Visa Business card instead of cheques so you can focus on the work you love. **Stay #GoodBusy with VISA Business.**

VISA



Improving **electrical safety** for *all* **Canadians**

ESFi Canada has set its sights

Electricity is a silent killer. It is invisible, odourless and, on contact, is highly toxic to humans of all ages. Every year, hundreds of North American children, adults and workers are killed or severely injured from unplanned electrical contact.

Electrical death and injury are devastating and highly preventable, and it is not just workers who suffer from electrical contact and fires caused by electricity. Children and homeowners are at risk from unsafe counterfeit products, overloaded circuits and outlets, as well as unsafe electrical work performed by people not licensed as electricians.

In May 2012, Electrical Safety Foundation International (ESFi) Canada invited 62 electrical safety experts to Canada's first National Electrical Safety Summit to discuss how to reduce death and injury by electricity.

The participants included: executives, CEOs and leaders from the electrical field; electricians; power generation, transmission and distribution; expert trade workers who work on or near electrical equipment; occupational health and safety experts; fire prevention; regulators; government; communications specialists; medical, surgical and rehabilitation experts; academia; researchers; electrical product manufacturers, distributors and retailers; standards organizations and counterfeit product specialists.

An appreciative frame of reference was employed in a collaborative setting, with experts seated at tables based on their specialty and expertise to identify best practices in all aspects of electrical safety and harm prevention, and to help identify gaps and opportunities for improvement. (This data would be used to guide the development of a long-term strategic plan for ESFi Canada.)

Six key electrical safety questions were asked of all summit participants, who were assigned to tables based on five specific areas of electrical risk:

- worker safety
- fire safety
- child safety
- home safety
- counterfeit and unsafe products.

Key questions asked with respect to electrical risk and safety were:

1. What keeps you up at night?
2. What are the biggest challenges?
3. What are the greatest opportunities?
4. What are the roles and priorities for ESFi Canada?

5. Who needs to be involved?
6. What issues require a national strategy?

Looking at the numbers

Household electrical cords represent the primary electrical hazard for children under 12 at 63% of all injuries, followed by outlets. High-voltage powerlines are the primary cause of injury to children over 12, accounting for 90% of all such injuries. Fortunately, the burn experience for children is decreasing from all sources, including electrical yet, given the mortality rate is so high for children under five (and the preventability of these injuries), more care must be taken to limit these types of incidents.

In a recent eight-year study covering the period 1998 to 2006, the Ontario Ministry of Labour (MoL) noted there were 1058 worker injuries and deaths due to electrical contact:

- 65 of these were fatalities
- 240 were critical injuries
- 753 were non-critical injuries, and
- 1293 were powerline contact events

The manner in which Harvard University risk scholar Dr. Malcolm Sparrow frames occupational risk illustrates how organizations such as ESFi Canada can play a meaningful role by developing a better understanding of the *Why?* behind occupational death and injury, and what can be done to reduce the occurrence of these life-changing incidents. Sparrow notes:

The risk literature so far has not given us a well-developed organizational theory for risk-control. Neither, conversely, has organizational theory paid explicit attention to the distinctive character of the harm reduction task.

Electrical incidents can be viewed as high-impact, low frequency (HILF) events because when a worker is injured by electrical contact and requires time off (lost time injury, or LTI), he is 100x more likely to die from those injuries as compared to all other LTIs combined. Out of sight, out of mind is also an issue with occupational electrical injury reporting; not reporting an electrical accident is easy when the contact leaves no burn, bruise or mark.

Risk perception is a serious factor in occupational settings: what one worker sees as a risk may not be seen in the same light by another. Human behaviour factors such as risk perception, hazard training and recognition, personality, retraining, apprentice training and

supervision, peer and supervisory influence, safety culture, education and economic realities all play a role in whether a worker will knowingly take a risk, or will bear a risk when another asks (or coerces) him to do so.

With respect to the human factors or behavioural aspects of improved electrical risk and safety, Canadians know the common electrical hazards at work, yet 60% of occupational electrocutions are due to improper procedure with 8% resulting from human error. Research by Williamson and Feyer (1998) shows that, in electricity-related fatalities, errors of omission (human behaviour) in the event just prior to the accident were the prime cause of electricity-related fatalities.

MoL notes in 2008 that fully 79% of all occupational injuries were experienced by workers who were not certified electricians, but rather apprentices, maintenance workers, equipment operators, labourers and drivers, and professional trades such as HVAC and elevator repair technicians, millwrights and supervisors.

Relative to homeowner awareness of electrical risk, ESFi Canada commissioned Leger Research in Spring 2012 to conduct a national survey of 1500 Canadian homeowners concerning their views on residential electrical safety with the following results:

- Parents with children in the house felt somewhat less safe, with adults over the age 45 more concerned about electrical safety for children as compared to younger adults.
- Virtually all Canadians feel safe from electrical hazard while in their homes, with the greatest concerns being poorly repaired or installed electrical wiring, along with overloaded outlets (56%). Yet 69% of all respondents say they used an extension cord or multi-plug to connect multiple electrical devices into a single outlet.

A mission is born

At the time of the May 2012 summit, there was no national body responsible for electrical safety in Canada; ESFi Canada (an affiliate of ESFi International in the U.S.) was created to address this gap. This is why, to get the ball rolling, ESFi Canada invited these subject-matter experts in the field of electrical safety to discuss what role a new national body could play toward the goal of improved electrical safety.

Based on feedback and advice from our expert stakeholders, ESFi Canada will attempt to address these gaps. Summit delegates

consistently mentioned several themes under two main categories: a) concerns raised, and b) opportunities for ESFi Canada.

Concerns raised

1. The need for education and communication of electrical risk and hazard for consumers.
2. The need for ESFi Canada to conduct research and aggregate national data on electrical injuries and their causes.
3. Education is needed for homeowners on the dangers of household fires, aging infrastructure, counterfeit products and electrical risk to children.
4. Research and communications are required on the risks and hazards of emerging electrical devices and systems.
5. Advocacy is needed for better training for all who work on or near electrical equipment and machinery.

Opportunities identified for ESFi Canada

1. Support ongoing electrical safety training for apprentices, electricians and all who work on or near electricity.
2. Become a centre of excellence for electrical safety research and dissemination in Canada.
3. Undertake occupational research into human behaviour modification to create a workplace culture of electrical safety by design to help eliminate live electrical work unless absolutely necessary.
4. Attract other stakeholders to join ESFi Canada, including Health Canada, natural resource extractors from all provinces and territories, National Council of Deans, municipals governments and similar bodies.
5. Educate workers and employers on the dangers of a risk shift that has taken place from the old days when a worker could live on the edge by risking live work, to now, where it is the employer who makes the choice for someone to work live.

Six potential roles were identified for ESFi Canada:

- researcher
- advocate
- research clearing house
- educator
- communicator
- national leader in electrical safety for consumers, workers, and their employers

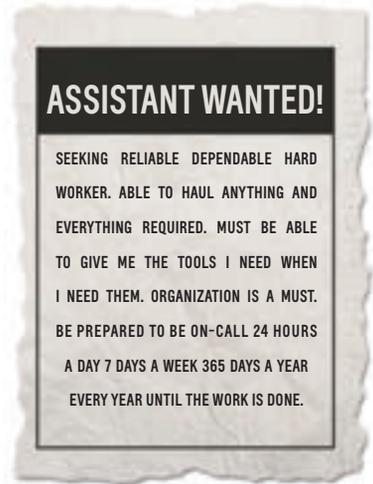
These are not easy shoes to fill because, as noted, electricity is invisible, toxic and odourless; as a source of harm, it suffers from the old adage: Out of sight, out of mind.

That said, ESFi Canada has set its sights on becoming the national go-to source for all research and information related to electrical safety, and will continue to

undertake and share leading-edge electrical safety research, and how best to apply these findings to help reduce electrical death and injury at home, play and work. **EB**

This article is based on the white paper "Electrical Safety Foundation International (ESFI), Canada: White Paper on Improving Electrical

Safety for All Canadians" written by Gavan Howe, Ph.D. (in progress), adjunct professor of organizational development at George Brown College, Faculty of Business. Gavan is also vice-chair of ESFi Canada and a member of IEEE Electrical Safety Workshop. For more information on ESFi Canada, visit www.esfi.ca or call Gavan at (416) 363-6591.



Position filled.

<p>OPTION A</p> <p>UP TO \$2657 - VANS UP TO \$1750 - TRUCKS WORK READY EQUIPMENT FROM ADRIAN STEEL</p>	<p>OPTION B</p> <p>\$450 COMMERCIAL UPFIT CASH BACK</p>	<p>OPTION C</p> <p>\$500 IN GM DEALER ACCESSORIES</p>	<p>OPTION D</p> <p>\$250 CASH INCENTIVE</p>
---	---	---	---

There's more riding on this vehicle than your equipment. When you run your own business your reputation is always along for the ride, and you can't afford to have a van or truck that can't be counted on.** The GM Business Choice program helps you build the vehicle you want the way you want it, as well as giving you a choice of one of four incentive options, so you get your vehicle, your way.*

gmbusinesschoice.ca



*Adrian Steel is a registered trademark of Adrian Steel. Value of equipment depends on upfit package selected. Eligible vehicles, equipment, tools and accessories may differ slightly from version shown. Customer may choose only 1 option (A,B,C,D) per eligible vehicle. All incentive packages are tax inclusive. Options B and C inclusive of parts and labour. Business Choice valid toward the purchase or lease of eligible new GM vehicles in Canada for eligible companies with an active FAN or business number. See Dealer for full program details and eligibility. **Contact your local dealer for details on all 4 Business Choice options. This offer expires October 31, 2013. ©Copyright 2013 General Motors of Canada Limited.



Transmission

stability and infrared windows

The effects of transmissivity on data accuracy

Martin Robinson

FIGURE 1

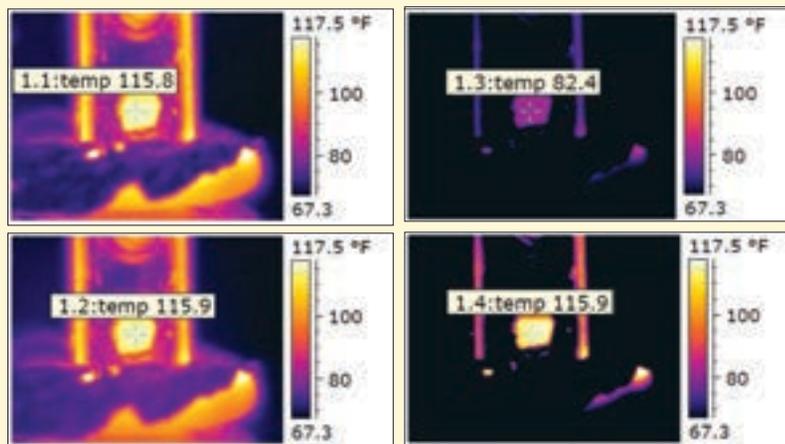
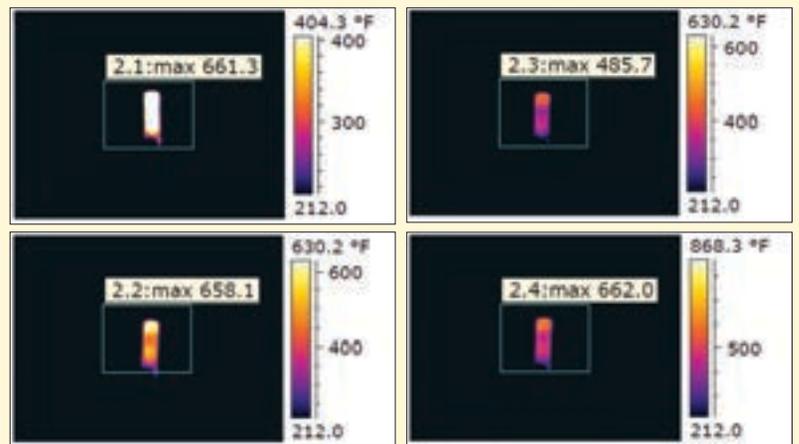


FIGURE 2



Garbage in, garbage out. This truism is every bit as applicable in thermography as it is in computer data-mining. The difference is that the inaccurate data that leads a thermographer to a false-negative conclusion could result in a multi-million dollar catastrophic failure of a company's electrical distribution system. In fact, the implications to personnel safety, plant assets and production downtime make the results of transmissivity errors more like toxic waste than mere garbage.

When using infrared (IR) windows or sight glasses, it is imperative to understand the accurate transmission rate of the optic used in the infrared window. Failure to accurately compensate for actual transmission attenuation can lead to significant errors in data. The magnitude of the error is based on the exponential effect that target surface temperature has on radiated infrared energy. In short, temperature differences (ΔT) will appear to be minimized when the effects of transmission attenuation are not considered nor accurately compensated for. Such errors in ΔT may, therefore, lead thermographers to underestimate the magnitude of many serious electrical faults.

Physics of thermography and temperature calculation

I have discovered many calcium-fluoride windows—even in controlled environments—have lost significant transmission rate within just a two- to three-year timeframe. In 2003, I came across a calcium-fluoride IR sight glass (Figure 1) that had lost all transmissivity in the infrared and visual spectra. It was being used in a motor termination box in an electrical generation plant. This is an extreme case, to be sure, but not impossible.

Upon reflecting on Dr. Robert Madding's original research on infrared window transmissivity, I became very interested in the practical

implications of transmissivity errors (short of complete transmission loss) on real-world inspections. Specifically, what degree of error could one expect to see when the transmission rate of an infrared window optic were to change, and when the thermographer failed to accurately compensate for that change?

For the purposes of this article, I will use the following definitions:

Emissivity (E) defined as the efficiency of an object's surface to radiate infrared energy.

Transmissivity (t) defined as the ability of radiation to pass through an object. Although target transmissivity is important and relevant in many thermography applications where radiated energy from sources behind the target might pass through the target and, thereby influence temperature calculations, this is generally not a factor in industrial electrical thermography applications where the predomination of targets are opaque (or non-transmissive in the long-wave infrared spectrum). Instead, I will focus on the use of IR windows and the implications of transmissivity, and use the term transmissivity interchangeably with transmittance, transmission, and transmission rate (whereas the rate is discussed as a fraction of being 100% transmissive).

Transmission degradation is the continued loss in transmission rate across the IR spectrum resulting from the nature of certain optic materials to lose transmission rate due to inherent properties of that material. (The focus here is on calcium-fluoride crystal windows [CaF₂], which is known to degrade due to its hydroscopic nature, and due to refraction caused by mechanical stresses of vibration and high-frequency noise.)

There is nothing that actually *measures* temperature; a thermometer, for example, measures the expansion of mercury against a static background. The amount the level of mercury rises is then correlated to a temperature. When the amount of mercury in the vial is less than that for which the lines were calibrated, then the apparent reading will be lower than the actual temperature. In this case, a mother might send her child to school with a 103° temperature thinking the child was a healthy 98.6°.

Similarly, a thermocouple does not measure temperature. The difference in voltage output from two dissimilar metals due to the thermoelectric effect can be calculated and correlated to known temperatures. When the amount of differential voltage is somehow filtered over a longer cable run, and that attenuating affect was not compensated for, then the resulting temperature calculation will be lower than the actual temperature of the bearing it was measuring. In this case, the PLC might fail to trigger an over-temperature alarm until the process seizes up.

Non-contact infrared thermography measures the radiated IR energy from a target. The amount of radiated energy is then calculated and correlated to specific temperatures. To ensure accurate temperatures and accurate comparisons (or differences in temperature, referred to as 'delta T' [ΔT]), the thermographer must have detailed knowledge of the science of IR radiation and properly control the variables affecting how the imager (camera) interprets and calculates the radiated IR energy it receives. These variables include (among others): the emissivity of the target; reflection of radiated energy from other sources; and transmissivity of the atmosphere and/or IR window being used.

To properly control for emissivity variations on electrical components, thermographers should standardize the emissivity by amending target surfaces with some type of highly emissive, permanent treatment. Common practices include grill paint, electrical tape or high-emissivity stickers—any one of which can give thermographers emissivity values of 95%. With consistent and high-target emissivity, reflection issues are minimized and a trained IR thermographer will be able to properly calibrate the imager for a target's emissivity value in most cases. This leaves the IR window's transmissivity as the key variable to control.

IR window transmission rates can be derived from the manufacturer's literature; however, this poses several potential problems:

1. Transmission rates are typically variable across the infrared spectrum (as shown in Madding, 2004). Yet the manufacturer's specified transmission rate is generally relevant for a specific wavelength and is, therefore, not necessarily accurate for thermography performed using standard IR cameras, which sense a wide band of infrared (e.g. 7.5µm to 13µm), rather than a single wavelength. Furthermore, the sensing arrays of different cameras have variable sensitivities along the infrared spectrum. Your camera might be more or less sensitive at the wavelength where a window manufacturer specified transmissivity.
2. When transmission values change over time, the manufacturer's specified transmission rate for a new window is irrelevant.
3. Some optic materials, such as CaF2, have been shown to vary from one window to the next (as shown in Daugherty, Newberry & Schewe, 2007).

A preferred method of establishing the baseline for transmittance adjustment is to calibrate the imager using an infrared window and a target that has achieved a stable temperature in the range in which you expect your actual target to be operating (as detailed in Madding, 2004). Doing so will give a thermographer the most accurate baseline transmissivity value. But what if that transmissivity value were to change? What effects will that change have on data accuracy?

Magnitude of error

One of the most misunderstood concepts in thermography is the degree to which errors in emissivity and window transmissivity calibration will affect temperature and ΔT accuracy. As demonstrated in the Stefan-Boltzmann Law, the radiated infrared energy emitted by a target surface is exponentially related to the absolute temperature of that surface:

Stefan-Boltzmann Law: $W = E\sigma T^4$ where

W = total radiant power in Watts/m²

E = emissivity (unitless)

σ = Stefan-Boltzmann constant (1.56X10⁻⁸W/m²K⁴)

T4 = temperature (absolute) in Kelvin

Therefore, as the temperature increases, radiant energy increases proportional to the absolute

temperature to the 4th power! An infrared camera's built-in calibration helps correlate this fact of nature into accurate temperatures and comparisons, but incorrect camera settings—such as emissivity and IR window transmission rates—will result in errant temperature values.

Furthermore, because the relationship is exponential, this error will worsen as the target gets hotter when

We Stock it Today... Because You Needed it Yesterday!

Save time and money at a hassle-free website where electrical professionals can select and order over 16,000 quality connector products!

Pin & Sleeve Connectors - IEC309



SCAME



Huge selection of Plugs, Connectors, Receptacles & Inlets in Watertight (IP67) or Splashproof (IP44) Versions. Manufactured to IEC 60309-1 & 60309-2 provides complete interchangeability with all major manufacturers. Single-wiring point access and built-in threaded cable gland makes assembly fast with excellent pull-out strength.

30 AMP PLUG 600V - \$91.79

60 AMP PLUG 600V - \$151.23

100 AMP PLUG 600V - \$268.53

Cord Grips & Cable Glands





OVER 600 SKUs IN-STOCK

- NPT, PG and Metric Threads
- Aluminum, Steel, Stainless, Nylon
- Multi Hole Bushings, Flat Cable, 45° & 90°

1/2" NYLON - FROM \$1.12

1/2" ALUMINUM - FROM \$4.69

1/2" BRASS - FROM \$5.95

NOW SHIPPING DIRECT FROM ONTARIO

FREE SHIPPING ON ORDERS OVER \$100

Visit our easy-to-use website www.elecDirect.com

Threaded Adapters



Compression Lugs



Clamps & Conduit Straps



Non-Metallic Enclosures





elecDirect.com®

www.elecDirect.com 1-800-701-0975 support@elecDirect.com

Sanborn, NY

transmission rates or emissivity settings are incorrect. Consider the effect on ΔT comparisons (whether between historical and current temperatures or real-time comparisons between two or more similar parts) that are, by their nature, a comparison between different temperatures: the resulting calculations are apt to be radically understated, which could easily lead thermographers to misdiagnose the severity of a fault.

When transmission rates are changing over time, and the thermographer is trending values to determine the health of an application, a steadily decreasing transmission

rate could cause temperature values to appear to be stable or decreasing over time, whereas temperatures may have actually been increasing significantly over the same period. The implications of flawed data to a reliability or predictive maintenance program are obvious.

Window test specifications

For the test window, I used a CaF₂ window that I have had in my possession for roughly two years, and is typical of those offered by various manufacturers. I use it for training purposes when discussing IR windows in my training classes. It has mostly been exposed to office and living environments with modest levels of humidity, temperature, vibration and high-frequency noise. I utilized a control window to provide a basis of comparison. The optic of the control is made of polymer with reinforcing grills on either side of the optic.

As with the test window, the control is a commonly used IR window I have been using for training purposes. As such, it has been kept in the same environmental conditions. One notable difference is that I have demonstrated the impact resistance characteristics of the control window many times by hitting the optic with various instruments. Those demonstrations have resulted in several superficial scratches and surface blemishes on the optic and grills.

This window makes a good control sample because the polymer optic has proved stable over time, even when exposed to a variety of environmental conditions. Furthermore, the polymer control window and the CaF₂ test window were shown to have nearly identical transmission characteristics when they were new.

For purposes of these tests, I used a FLIR P65 infrared camera, with a standard 24° lens. When taking images through the infrared windows, the camera lens was pressed up to the window optic, as is standard practice.

The window temperature and reflected apparent temperature were the same as ambient temperature. The targets were placed about 18 in. from the window. Care was taken to ensure that targets were in focus. The low-temperature target was a standard overhead line clamp. Electrical tape was affixed to the bolt head to serve as the target, and E was adjusted to 0.95. The target was placed on a hot plate and its temperature allowed to stabilize at 115.8F.

The high-temperature target was a soldering iron tip. Emissivity of the iron's tip was known to be 0.95 from an earlier test. The imager was adjusted to compensate for emissivity, and the soldering iron was left running until its temperatures stabilized at 661.3F.

Test: effects of transmission degradation

When the control and test windows were new, they both exhibited a transmission rate of 49%. Therefore, a thermographer using either window would expect to receive accurate data were they to adjust their imager to compensate for the attenuating effect of the secondary optic. However, this was not the case for the

CaF₂ window. (For details on how to test and adjust for transmission attenuation, refer to Madding, 2004.)

Test 1: Low temperature

Thermogram 1.1 shows the thermal image of the overhead line clamp with no infrared window. The target temperature is shown to be 115.8F. We will call this the true temperature.

Thermogram 1.2 shows the same target through the polymer control window, with the t set to 0.49 per the baseline established when it was new. The target temperature is shown to be 115.9F—a statistically insignificant 0.09% error between apparent and true temperatures, which is well within the $\pm 2\%$ accuracy ratings for the camera used in the tests.

Thermogram 1.3 shows the same target through the CaF₂ test window with the t set to 0.49 per the baseline established when it was new. In this case, however, the apparent temperature registers as 82.4F, resulting in a 33.5F or 28.84% error between apparent and true temperatures.

Thermogram 1.4 shows the target after recalibration of the imager to the degraded t value of the CaF₂ test window. Transmittance was adjusted to 15% to bring the apparent temperature in line with the true temperature. This represents a 69.4% degradation in transmission of the CaF₂ Test Window over a two-year period.

Test 2: High temperature

Thermogram 2.1 shows the thermal image of the soldering iron tip with no IR window. The target temperature is shown to be 661.3F. We will define this as the true temperature of the target.

Thermogram 2.2 shows the same target through the polymer control window, with the t set to 0.49 per the baseline established when it was new. The target temperature is shown to be 658.1F, a 0.49% error between apparent and true temperatures. Again, this margin of error is not significant, since it is well within the camera's $\pm 2\%$ accuracy specifications.

Thermogram 2.3 shows the same target through the CaF₂ test window, with the t set to 0.49 per the baseline established when it was new. In this case, the apparent temperature registers as 485.7F, resulting in a 175.6F or 26.55% error between apparent and true temperatures.

Thermogram 2.4 shows the target after recalibration of the imager to the degraded t value of the CaF₂ window. Transmittance was adjusted to 30% to bring the apparent temperature in line with the known true temperature. Notice that this differs from the 15% transmittance at the lower temperature, confirming Madding's findings with regard to the variability of CaF₂'s transmittance across the long-wave infrared spectrum.

Conclusion

It is critical to choose an infrared window made with materials that are designed for the environment in which you will be using them. As stated in 1.3 of the UL 50V standard for



Take a step towards trade certification.

Electrical Techniques:

Gain solid understanding of the various technical elements of the electrical trade and gain experience with trade regulations and practices - the first step towards a career in the trade.

Electrician Construction and Maintenance Apprenticeship:

This program teaches high-level skills in power, lighting and central systems, and gives you hands-on experience during the 8- or 10-week school session.

Electrician Industrial Apprenticeship:

The industrial electrician powers, controls, and maintains Ontario's factories, plants, and industries. You will gain knowledge in state-of-the-art technologies and apply these skills during your apprenticeship.

Contact Humber for more information
Michael Auchincloss, Program Coordinator
416.675.6622 x 78002
michael.auchincloss@humber.ca



infrared viewports, "The acceptability of an infrared viewport in any particular application depends upon its suitability for continued use under the conditions that prevail in actual service". In other words, it is incumbent on the purchaser of the window to understand whether a window will suffer degradation due to exposure to the environment in which it will be used.

When IR windows are properly compensated for, as with the polymer control window used in these tests, it was easy to obtain accurate data that could be trusted.

The control window used in my tests is made of a polymer that maintains a stable transmission rate in a variety of conditions. In this test, it proved to maintain a stable transmission rate over a two-year period, even when subjected to abusive impact-resistance demonstrations. I am confident that the data taken through this type of window will be accurate when a qualified thermographer controls for relevant variables.

Conversely, after just two years in relatively controlled environments, my CaF2 window has shown considerable transmission degradation, and is not yielding accurate results. In both tests, the temperature error using the CaF2 Test Window was in excess of 25%. To make matters worse, the error resulted in apparent temperatures that were lower than the true temperature, meaning the error is likely to produce a false-negative result for the thermographer. Furthermore, there was no visible evidence of the change in transmission rate, so the thermographer would likely have no obvious cues to check for transmissivity changes.

In the event that a thermographer is using an IR window material which is known or suspected to degrade over time, accuracy dictates periodic recalibration of the camera to the changing transmission rate of the window optic so the new transmission rate can be known and compensated for. The recalibration requires the thermographer to test each window with a target of a known temperature. Therefore, the panel cover holding each window must either be removed or opened for window calibration. In industrial applications this is best done during a shutdown for time and safety reasons. It may not seem practical, but it is absolutely necessary when data from a degrading optic is to be accurate and trusted.

Just as an infrared imager will periodically calibrate itself to compensate for drift caused by the effects of temperature on the camera's germanium lens and internal components,

a thermographer must calibrate his imager to account for attenuation through an infrared window. When the thermographer chooses a window with an optic that remains stable over time in their environment, this calibration can be based on a one-time transmission test when the window is new. Otherwise, periodic recalibration will be required to ensure accuracy. **EB**

Resources

1. Madding, Dr. Robert. "IR Window Transmittance Temperature Dependence." Infrared Training Center, FLIR Systems, Inc. 2004.
2. Daugherty, Newberry & Schewe, "Opening the Windows." UpTime Magazine. Nov 2007: p. 22.

Martin Robinson (www.iriss.com) has been a player in the field of condition-based maintenance technology for over

30 years, and has met with, consulted or advised international maintenance and reliability leaders on electrical preventive maintenance (EPM) and electrical safety standards of NFPA and OSHA. He is a member of IEEE, NFPA and is a standing member on the technical committee CSA Z463 guidelines on maintenance of electrical systems, and a member of the IEEE P1814 working group.

leaders in led lighting

**60W, 80W & 100W
explosion proof**

dimmmable
5" & 6" LED Recessed Retrofit Module Trim

dimmmable
4" LED Recessed Retrofit Module Trim

up to 96,000 lumens

20W, 30W & 50W

**30W to 200W
2,600 - 16,000 lumens**

BANVIL 2000

www.banvil2000.com
1-888-8BANVIL (22-6845)

TOP 10 THINGS

NOT TO DO when taking electrical measurements



Colin Plastow

Anyone who makes their living by working with electricity quickly develops a healthy respect for anything that possesses even a remote chance of being live, yet the pressures of getting a job done on time or getting a mission-critical piece of equipment back online can result in carelessness and uncharacteristic mistakes by even the most seasoned electrician.

Here are Top 10 Things *Not To Do* when taking electrical measurements:

1. | Replace the original fuse with a cheaper one

If your digital multimeter (DMM) meets today's safety standards, that fuse is a special safety sand fuse designed to pop before an overload hits your hand. When you change your DMM fuse, be sure to use the correct replacement specified by the manufacturer.

2. | Use a bit of wire or metal to get around the fuse

This may seem like a quick fix when you're caught without an extra fuse, but the first fuse blew for a reason. It protected you and your meter. Why would you want to defeat that safety protection?

3. | Use the wrong test tool for the job

It's important to match your equipment to the work ahead. Make sure your test tool holds the correct Cat and voltage rating for each job. Determine the highest rating you may need, then ensure your equipment has that same—or higher—rating.

4. | Grab the cheapest DMM on the rack

You can upgrade later, right? Maybe not, if you end up the victim of a safety accident because that cheap test tool didn't actually contain the safety features it advertised. As with most things, you tend to get what you pay for. Look for independent certifications such as CSA or cUL when choosing a test tool.

5. | Leave your safety glasses in your shirt pocket

Take them out. Put them on. It's important. Ditto for your insulated gloves and flame-resistant (FR) clothing, and any other required PPE (personal protective equipment).

6. | Work on a live circuit

De-energize the circuit whenever possible. Should the situation require you to work on a live circuit, use properly insulated tools, and wear your hearing protection, safety glasses, arc-rated face shield or hood (if required) and insulated gloves. Remove watches or other jewellery, stand on an insulated mat and wear FR clothing, not regular work clothes.

7. | Fail to use proper lockout/tagout (LOTO) procedure

8. | Keep both hands on the test

Don't! When working with live circuits, remember the old electrician trick: keep one hand in your pocket. This

lessens the chance of a circuit path across your chest and through your heart. Hang or rest the meter on something when possible. Try to avoid holding it with your hands to minimize personal exposure to the effects of transients.

For hazardous measurement applications, additional measures for reducing the risk of hazard and arc flash should be considered. These include the use of PPE as prescribed by standards such as CSA Z462 and NFPA 70E.

9. | Neglect your leads

Test leads are an important component of DMM safety. Make sure your leads match the Cat level of your job, as well. Look for test leads with double insulation, shrouded connectors, finger guards and a non-slip surface.

10. | Hang onto your old test tool forever

Today's test tools contain safety features that were unheard of just a few years ago—features that are worth the cost of an equipment upgrade and a lot less costly than an emergency room visit.

Safety standards for test equipment have changed significantly over the years, and instruments certified to the latest standards have significantly more built-in protection than older units. For example, a newer requirement is that the user be protected against accidental misuse. What if your meter was set to measure resistance then connected across a live voltage source? It's not a difficult mistake to make. Would you feel comfortable about the protection built into your meter? If not, it's time to review the safety rating of your equipment and update as required.

Now that I've gone through my Top 10 Things Not to Do, here are some best practices for safely taking electrical measurements:

HAMMOND MANUFACTURING™
Quality Products. Service Excellence.

Stainless Steel Enclosures

Hammond gives you options

- Wide range of standard designs and sizes
- Large inventories of 304 and 316 SS products
- Flexible modification services program

Modification Services

Contact your Hammond Rep today or visit:
hammondmfg.com

CAN 519.822.2960 | USA 716.630.7030 | sales@hammfg.com

1 Measure voltage at the point of lowest available energy

For example, when you are measuring voltage on a breaker panel, identify the lowest-rated breaker available and make your measurement there. This way, you have more protection between yourself and the potential hazard.

2 Take steps to obtain the best reading within the necessary envelope of safety

When conditions require that both of your hands are needed for a safe measurement, set the instrument down; use the instrument's bail stand (when equipped with one). Better yet, use a magnetic hanger to hang the unit at eye level on the edge of the panel. Don't try to watch the meter while you make your measurement: always keep your eyes on your test probes.

3 A tip about tips

When making measurements in or around high energy three-phase distribution panels, use test probes with a minimum amount of exposed metal at the probe tips, such as 4-mm metal-tip probes. This reduces the risk of an accidental arc flash from probe tips being inadvertently shorted together between phases.

4 Be cool; keep a hand in your pocket

Keep one hand in your pocket or out of the panel and the measurement circuit. You don't want to offer current a path through your body. Whenever possible, use a properly rated alligator clip to attach the Black test lead to the circuit under test. This leaves you with a free hand for probing with the Red test lead.

5 Practise safe lead connections

When taking single-phase measurements, always connect the neutral lead first and the hot lead second. After taking your reading, disconnect the hot lead first, then the grounded lead.

When testing for voltage, use the three-point test method:

1. Test a similar known live circuit first.
2. Test the circuit to be tested.
3. Re-test the first known live circuit.

This process verifies your test instrument is working

properly—an important part of your personal safety.

6 Consider using wireless instruments

Often, the safest way to take measurements is remotely so as not to be exposed to the conditions in the area in which the measurement are to be made.

Use the correct tools correctly

Measuring live voltages and current in today's high-energy environments can result in a severe hazard to equipment and users when proper precautions are not applied. Given the risk of transients, surges and human error, it always pays to follow safe work practices and to only

use test instruments rated and certified to your measurement environment. **EB**

Colin Plastow has been with Fluke Electronics Canada since 1987 in various support and product management positions. You can contact him at colin.plastow@fluke.com.

THINK OUTSIDE OF THE LED BOX!

Venture's 125W SPL Lighting System Was Specified Instead of an LED Option

ENERGY SAVING LIGHTING UPGRADES THAT ARE NOT LED!

The advertisement features a photograph of a large, multi-story brick building at night, illuminated by warm, yellow lights. In the foreground, a cardboard box labeled 'LED's' is overflowing with colorful, multi-colored LED lights. A single, larger, clear glass metal halide light bulb lies on the ground next to the box. The background shows a street with parked cars and a clear night sky.

Venture's Super Pulse Start Long Life (SPL) metal halide system is being chosen over LED options.

Compared to LED, Venture Lighting is:

- Lower initial cost, lower replacement cost, lower life cycle cost
- More light with same life span
- High CRI (90+)
- Immediate and greater return on investment



800-265-2690

For more information about these products, and where to find a local representative go to

VentureLighting.com/Canada



VENTURE
LIGHTING



New addressable FIRE SYSTEM hits a home run for the FISHER CATS



THE ELECTRICITY WORKFORCE
EVENT OF THE YEAR

Empowering the future today



#ElectricityHR13

Hotel InterContinental Toronto Centre
November 6-7, 2013, Toronto, Ontario

Join Us

- The National event dedicated to the workforce of the electricity and renewable energy industry
- Hear from knowledgeable speakers on practical and innovative solutions to overcome workforce challenges
- Network with key industry decision makers and peers

Join industry employers, labour organizations, educators and government representatives for the electricity and renewable energy HR event of the year.

Sessions of Interest

There will be sessions to help your organization address the workforce challenges facing the sector today that will include such topics as knowledge transfer and diversifying your workforce.

New this year will be the Inaugural Awards Gala that will provide national recognition for the achievements of individuals and companies working in the electricity and renewable sector in Canada, celebrating innovation in workforce development in the industry.

Register Now

Early bird Registration deadline is September 30th
For more information, visit:
www.electricityhr.ca/conference

The New Hampshire Fisher Cats—the Toronto Blue Jays’ Double-A affiliate team—has hit a home run through the replacement of their stadium’s old, damaged fire system with a new addressable fire system promising more robust surge protection.

The old legacy system was badly damaged in a snowstorm when a power surge took the system offline and damaged a number of integral components, leaving the stadium vulnerable.

Stadium officials worked with fire alarm and security integrator Capitol Alarm Systems Inc. (Penacook, N.H.) to identify a more reliable, surge-resistant replacement. Value and dependability were two key factors stadium officials sought when choosing the replacement system, explained Shaun Meredith, director of facilities at Northeast Delta Dental Stadium, the Fisher Cats’ home base.

“It’s a large investment for us and we wanted to make sure we were getting a good value for what we were paying for,” he explained. “It’s a ballpark; it’s a large facility and we needed a dependable system that would allow us to identify and take care of any issues as quickly as possible.”

The fate of the old fire alarm’s run-in with transient voltage made the

replacement system that much more attractive: to increase protection against electric shock damage to its systems, Fire-Lite Alarms redesigned its control panels’ major hardware components, promising more robust surge protection. For fast diagnostic purposes, new colour-coded LEDs were also added, indicating status of the panel’s operations and, when necessary, where service on the system is required.

“Obviously, that was a big factor in our decision-making process. We wanted something that had good surge protection and was reliable,” said Meredith. “In looking at this system, it was a good fit for what we were looking for at the ballpark.”

The heart of the new system

At the heart of the stadium’s new system is an MS-9200UDLS fire alarm control panel, which can monitor as many as 198 initiating devices, such as detectors and pull stations.

“It was low-cost, low-budget, but high-quality... all the things you want,” said Roger Laro, Capitol Alarms’ vice-president of operations. “We put it in, got it inspected, and they had a flawless opening day.”

The stadium managers were looking for a system that was simple to operate



without any issues. That's a vast improvement from the old system, which was having technological troubles on a weekly basis, said Laro.

"They've almost forgotten about it now," said Laro. "It was a seamless transition." 

This case study was submitted by Fire-Lite Alarms, part of the Honeywell Fire Systems Group (www.honeywell.com).

and simple to maintain, Laro explained. The MS-9200UDLS panel contains a single circuit board, mounted to its enclosure by a quick-remove chassis. According to Laro, this unique feature makes a fix simple.

"If there's a problem, you just put in a new board. You're in and out in an hour," explained Laro.

Considering the stadium's old system was constructed on proprietary technology, facility management favoured the new system's open source capability, which allows service to be performed by any qualified company and even the knowledgeable facilities staff. Being locked into one service provider for all system fixes—big and small, at non-negotiable prices—is one situation stadium management wanted to avoid.

"They can save themselves time, money and effort without having to call us in," said Laro.

The system was rounded out with five addressable duct detectors, numerous remote test sensors and indicators in elevator pits, hard-to-get-to spaces and rooms, and other places. Laro ran 24 circuits of visual strobes and a 32-zone graphic annunciator, as well.

The system communicates all alarms, troubles and supervisory issues to a central monitoring station while simultaneously reporting those same signals to stadium officials via email. For convenient updates on the system's status, including alarms, Capitol Alarm installed a remote annunciator in the stadium's front entryway.

"They've got a system they can depend on; a system that notifies them about any problems before the authorities call them and ask them to come down," said Laro.

So far, the new fire alarm system has been protecting the Northeast Delta Dental Stadium



We Light Up Your Life!

Stanpro Lighting Systems

has Canada's widest choice of energy efficient technologies...

It's simple. The choice is yours.

Induction

- up to 50% energy savings
- up to 10 year warranty



LED

- up to 50% energy savings
- reduced footprint
- up to 5 year warranty



Tel.: 514-739-9984 • Toll free: 1-866-280-2332 • Fax: 514-739-9912 • www.stanprols.com



Termination clauses de-mystified

A termination clause sets forth the conditions under which a party may terminate or bring a contract to an end before it has been fully performed or expired. Without a termination clause, the right of the parties to terminate would be determined under the common law, which provides that a contract can only be terminated by one party when the other party has breached a condition of the contract rather than a warranty.

Whether a particular provision amounts to a condition or warranty can often be a complicated matter, so expressly setting the specific rights and remedies on termination is always preferable than relying upon the uncertainties of the common law.

Three types of termination clauses are common in most commercial agreements:

1. Termination for convenience
2. Termination for cause provision
3. Termination for a prolonged *force majeure* event

1. Termination for convenience

A termination for convenience clause grants one party the right to terminate the contract without a specified event of default on the part of the other party. Owners—particularly public owners—often include such provisions when uncertainties exist around issues like funding or approvals. These clauses normally include a notice provision and describe the extent of termination compensation that will be paid to the service provider, if any.

From the perspective of the service provider, two key issues should be kept in mind. First, it is preferable to limit the circumstances under which a party may terminate for convenience. For example, an owner should not be able to avail itself with this remedy to execute the work itself or to arrange for the work to be executed by another service provider.

Second, it is important to ensure the termination payment fully

compensates the service provider. At a minimum, a termination payment should include compensation for all services performed to the date of termination, reimbursement for any demobilization costs and for any breakage fees or costs associated with the termination of subcontracts and/or supplier agreements. A service provider should also seek compensation for its loss of profits for the unperformed remainder of the work (although this is often resisted by owners).

2. Termination for cause provision

A termination for cause provision is intended to describe the events or causes that permit the innocent party to terminate an agreement. Typically, such clauses provide for notice and a ‘cure period’ during which the defaulting party is permitted an opportunity to remedy its default. For an owner, the standard event of default is a failure to make timely payments. In addition to the right to terminate, an owner default sometimes triggers a right for the service provider to suspend services. Owners are usually granted a cure period to remedy a payment default.

When considering a termination for cause provision, specific attention should be given to the extent of the notice required and the length of any applicable cure periods. Most commercial agreements provide cure periods for defaults relating to performance as opposed to defaults relating to insolvency, which cannot be cured. The length of the cure period should be sufficient to allow the defaulting party to meaningfully address the default and effect a cure. While specific time periods are typical, it is often useful to include further language that provides that, so long as the defaulting party has commenced its cure and is diligently pursuing it within the applicable cure period, a reasonable extension to the cure period will be permitted.

The description of the events of default that trigger the right to terminate is another important consideration. Events of default should be clearly described and should only include material obligations.

Finally, the right of the innocent party upon the termination should be set out. Some clauses specify set-off rights, the right to take possession of the work, the rights to utilize the equipment of the defaulting service provider, and the right to charge back the defaulting party for all costs that flow from the termination. They also often address matters such as demobilization from site, requirements to execute and deliver all documents, and the assignment of any applicable subcontracts, subconsultant or supplier agreements.

3. Termination for a prolonged *force majeure* event

The third type of termination provision is one that permits a party to terminate an agreement where a *force majeure* event has persisted for a specified period. *Force majeure* provisions are intended to address events that are beyond the reasonable control of either party, such as “acts of God”.

Such provisions excuse performance by the contracting parties during the event. However, when the delay is protracted, a right to terminate (which is normally a mutual right) is triggered. Although often resisted by owners, it is advisable for service providers to seek to have such clauses include a right to reimbursement of direct costs that flow from the termination.

Heed survival clauses

Finally, attention should always be given to survival clauses, which are included in most commercial agreements. Such clauses expressly confirm that certain rights and obligations continue in full force and effect after the termination of a contract. Contractual obligations such as indemnities, intellectual property rights, warranties and confidentiality usually survive, notwithstanding a termination.

Many contracts list the specific clauses that are to survive. While an owner who terminates a service provider for cause may not seek to enforce such obligations, it is important for the defaulting party to understand that such obligations may continue after termination. **EB**

Ian Houston is regional leader of the Construction, Engineering, Surety and Fidelity Group in the Toronto office of Borden Ladner Gervais LLP (www.blg.com), and a Fellow of the Canadian College of Construction Lawyers. His practice ranges from providing commercial law advice on contractual and procurement issues, to assisting clients in resolving disputes through litigation or alternative dispute resolution methods. Ian can be reached at ijhouston@blg.com or (416) 367-6111.

Visit **EBMag.com** and click **Calendar** to see an extensive list of upcoming events.

CANew (Canadian Airports National Electrical Workshop)
Canadian Airports Electrical Association (CAEA)
September 23-29, Campbell River, B.C.
Visit www.canew.ca

15th Annual IDEA E-Biz Forum
Industry Data Exchange Association (IDEA)
September 25-27, Orlando, Fla.
Visit www.idea-esolutions.com/ebizforum/agenda

CANDU Energy Suppliers Day 2013
Organization of Canadian Nuclear Industries (OCI)
September 26, Mississauga, Ont.
Visit oci-aic.org/oci-events

Partners in Training:
September 24, Sudbury, Ont.
October 17, Mississauga, Ont.
Visit www.partnersintraining.ca

56th Annual IEC National Convention & Electric Expo
Independent Electrical Contractors
September 25-28, Portland, Ore.
Visit www.ieci.org/convention-and-expo

IIDEX Canada
September 26-27, Toronto, Ont.
Visit www.iidexcanada.com/2013

IN CASE YOU MISSED IT...

VIDEO • EBMag attends the launch of the instructor training pilot of EVITP (Electric Vehicle Infrastructure Training Program) Certification for Canada. But what exactly is it? Visit bit.ly/15xZQm0.

PHOTOS • See photos from the Affiliated Distributors (AD Canada) Reception held during EFC's Electrical Council's annual conference. Visit bit.ly/15y1G6k.

PHOTOS • Catch up with old friends and unwind after a long week at the office at the Ontario Energy Network (OEN)'s annual Spring Networking Event at Woodbine Racetrack. Visit bit.ly/16eXKU7.

PARTNERS
in Training

EBMAG PRESENTS:

Partners in Training 2013

- **September 24**, Sudbury, Ont. "Shut Downs & Turnarounds"
 - **October 17**, Mississauga, Ont. "Maintenance & Reliability"
- Visit www.partnersintraining.ca

BICSI Fall Conference & Exhibition
September 15-19, Las Vegas, Nev.
Visit www.bicsi.org

EB
WILL BE
THERE!

OCI Annual Golf Tournament
Organization of Canadian Nuclear Industries (OCI)
September 18, Brampton, Ont.
Visit oci-aic.org/oci-events

ECAO Annual Industry Conference
Electrical Contractors Association of Ontario
September 18-22, Niagara-on-the-Lake, Ont.
Visit www.ecao.org

EB
WILL BE
THERE!

IAEI Canadian Section Conference
International Association of Electrical Inspectors
September 20-22, Saskatoon, Sask.
Visit www.iaei.org

OEN Luncheon Series:
Colin Andersen, OPA CEO
Ontario Energy Network
September 23, Toronto, Ont.
Visit www.ontarioenergynetwork.org

60th IEEE IAS PCIC Annual Conference
Industry Applications Society, Petroleum & Chemical Industry Committee
September 23-25, Chicago, Ill.
Visit www.ewh.ieee.org/soc/ias/pcic/index.html

IP 67 Water Resistant Data Connectors for



CONEC's line of Industrial Circular Connectors solves your problem of providing high speed data in hostile environments - both Indoor and Outdoor.

These connectors have been engineered to withstand temperature extremes as well as the effects of water and common industrial liquids.

Product Families include:

- **RJ45** (Plastic or all metal housings)
- **USB 2.0** (Receptacles, plugs and cable assemblies)
- **Mini USB** (Ideal for handheld devices)
- **Fiber Optic LC** (Duplex couplers, plugs, cables including outdoor rated)



Efficient Technologies
Designed to Perform

CONEC Corporation

125 Sun Pac Blvd.
Brampton Ontario • Canada L6S 5Z6
Tel.: +1 905 790 2200 • Fax +1 905 790 2201
E-mail: info@conec.com • www.conec.com

CONEC
TECHNOLOGY IN CONNECTORS™

Eye Lighting introduces LEDioc LED retrofit lamps



Eye Lighting has introduced new LEDioc brand lamps, which it says was designed for simple and easy field retrofit from an HID to LED light source in post-top and pendant luminaires. The 37W Eye LEDioc lamp, consuming 42 system watts, comes with a driver and surge protector, and can be applied in 120V through 277V systems.

The 5000K model provides 4,400 initial lumens, 70 CRI, and 106 lumens per watt, while the 3000K model provides 3100 initial lumens, 85 CRI, and 75 lumens per watt. Both feature 70% lumen maintenance at 50,000 hours of life.

EYE LIGHTING
www.eyelighting.com

16 million lighting colours available in Philips hue LED system



Hue, by Philips, claims to be the world's first web-enabled LED home lighting system available direct to the consumer. Users set up the system by downloading the hue mobile application, which is compatible with iOS and Android devices, to remotely control their home lighting for added security, personalize their lighting experience with custom settings, or program timers to help manage daily schedules. Choose between more than 16 million colours to customize the lighting in each room—users can also mimic colours in photos by simply dragging and dropping within the app. Offered exclusively through Apple stores, the hue starter kit includes four pre-programmed

light settings and three standard LED bulbs, which are more than 80% energy efficient than traditional light bulbs, says Philips.

PHILIPS
www.meethue.com

Fulham launches HighHorse gas station canopy fixture retrofit kit



Fulham Co. Inc. has launched a pre-tested kit for retrofitting gas station canopy fixtures from HID (high-intensity discharge) technology to HighHorse brand induction technology. Compared with traditional HID technology, Fulham says induction provides 40-50% energy savings, and promises greater lumen maintenance over time. These cULus kits are thermally tested as standard lighting alternatives for use with three common canopy fixture mounting types: enclosure, top-of-fixture, and surface 2 x 2-ft box.

FULHAM
www.fulham.com



What's Your Workplace Electrical Safety Plan?

If your employees are required to work on or near electricity, then they are at risk for injuries, even fatalities. CSA Group offers **print & electronic publications, classroom, online & on-site training**, and other tools & resources that can guide you in implementing an effective workplace electrical safety plan.

For more information and/or course dates and locations, visit shop.csa.ca or call 1-800-463-6727

USE THIS CHART TO BUILD YOUR PLAN

	Publication	Training	Guidebook/ Tool
UPDATED CSA Z460 <i>Control of Hazardous Energy – Lockout and other Methods</i>	✓		
CSA Z462 <i>Workplace Electrical Safety</i>	✓	✓	
NEW CSA Z463 <i>Maintenance of Electrical Systems</i>	✓	✓	✓
2012 Canadian Electrical Code, Part I	✓	✓	✓
CSA Z1000 <i>Occupational Health & Safety Management</i>	✓	✓	
NEW CSA Z1001 <i>Occupational Health & Safety Training</i>	✓		

EMT

BUSHINGS

THE BEST CABLE PROTECTION

- Fast & easy press-on installation
- Holds tight as cables are pulled
- Protects cable from abrasion
- Less expensive alternative to costly fittings when used just for wire



EMT400
Also for rigid, IMC and PVC rigid conduit



In a variety of sizes for 1/2" to 4"
- EMT
- Rigid
- PVC

Listed for Air Handling Spaces



Arlington 800/233-4717 • www.aifittings.com



CED1 facing OUT

View Video



CED1



CE1 facing IN

View Video



CE1

CE2 facing IN



Arlington 800/233-4717 • www.aifittings.com

NON-METALLIC

THE SCOOP™

ENTRANCE PLATES & HOODS

The **SCOOP™** series of reversible, non-metallic, single and two-gang entrance HOODS and PLATES protect cable while delivering good looks and installation versatility. They also reduce labor and eliminate extra connections.

CED1, CEDH1 vertical or horizontal HOODS for decorator-style wall plates. **CABLE ENTRY DEVICES**, CE1, CE2 single or two-gang PLATES that install facing in or out and other time saving styles!

- Easy to install facing IN or OUT
- Low voltage cable protection
- All white paintable plastic
- Best way to run cable where needed

CED130 cable entry device w/ slotted cover in Arlington's TV BOX™



© 2009 Arlington Industries, Inc. Patent pending

BOX EXTENDERS

CSA LISTED

FOR SETBACK ELECTRICAL BOXES



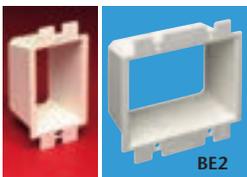
BE1



Our **CSA/UL Listed** Box Extenders extend set back electrical boxes up to 1-1/2".

- Heavy-duty, non-conductive plastic
- Level, support wiring devices
- Protect wires against damage, stripping

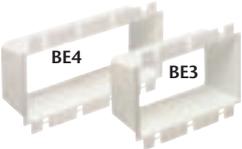
BE1R for round or octagonal boxes, the single and two-gang for all standard devices, switches and GFCIs – now **three- and four-gang box extenders for multiple gang boxes!**



BE2



BE1R



BE4

BE3



View Video



Try them *all* for the safe, easy way to meet CEC 12-3018 (1) for flush boxes!

Arlington 800/233-4717 • www.aifittings.com

THE INDUSTRY STANDARD FROM ARLINGTON

SNAP²IT® CONNECTORS

NO TOOLS • EASIEST CABLE INSERTION • SECURE HOLD



SAVE ^{about} 17 seconds per connector!

- Easiest cable installation
- Widest total cable ranges for our ENTIRE line: 14/2 to 3/3... Compare the ranges for our most popular Snap2It® connectors **38AST** and **40AST** vs **3810AST** and **4010AST** in the charts below. *Larger Snap2It connectors also available...*
- Widest variety of cables AC90 and ACG90, AC, MC, HCF, MC continuous corrugated aluminum cable, MCI-A cables (steel and aluminum).
- Fast, super-secure installation No chance of pullout!
- Removable, reusable from cable or box...easy!



WIDEST CABLE RANGES FASTEST INSTALLATION



404010AST (383810AST)

SNAP2IT® CABLE RANGES

CABLE TYPE	38AST 3838AST		40AST 4040AST		3810AST 383810AST		4010AST 404010AST	
	Dia. Range	Cable Range	Dia. Range	Cable Range	Dia. Range	Cable Range	Dia. Range	Cable Range
MC/HCF/AC Steel & Aluminum	.405 to .605	14/2, 12/2	.485 to .610	14/3, 14/4, 12/2	.370 to .490	14/2, 12/2	.405 to .610	14/3, 14/4, 12/2, 12/3, 12/4
MCI-A Steel & Aluminum	.440 to .550	with / without ground	.480 to .580	12/3, 12/4	.370 to .490	with / without ground	.405 to .610	12/3, 12/4, 10/2, 10/3
AC90, ACG90	.450 to .550	14/3, 12/3	.480 to .550	10/2, 10/3	.450 to .480	14/3	.480 to .550	10/2, 10/3
Flexible Metal Conduit Steel & Aluminum (RWFMC)	3/8" Flex		3/8" Flex		3/8" Flex		3/8" Flex	



Arlington

Patented. 800/233-4717 Scranton, PA 18517 www.aifittings.com



Arlington releases bronze grounding bridge GBB5250

Arlington Industries says its new heavy-duty bronze grounding bridge (catalogue #GBB5250) provides reliable intersystem bonding between power and communication grounding systems. Four termination points—one more than required by 250.94 of the 2011 NEC—handle multiple

hookups of communications systems like telephone, CATV or satellite dish. It accommodates a large 250 mcm conductor and #14 to #4 AWG copper or aluminum, solid or stranded intersystem bonding, grounding conductors. The grounding bridge is CSA/UL Listed.

ARLINGTON INDUSTRIES
www.aifittings.com

Nexans offers EnergeX Extra with Dow Endurance HFDC-4202 insulation



Global cable player Nexans says its newest product—EnergeX Extra—is made possible through the conversion of its medium-voltage production to employ Dow Endurance HFDC-4202 tree-retardant cross-linked polyethylene (TR-XLPE) insulation. The company explains the advantages of the new cable include: improved resistance to water tree growth; higher retained dielectric strength after ICEA 360-day Accelerated Water Treeing Test (AWTT); and reduced cost of ownership through longer cable life. Nexans says it has received certification to CSA C68.5 (primary shielded and concentric neutral cable for distribution utilities), and is eligible to apply the CSA mark on products manufactured with this insulation. The company adds EnergeX Extra made with the HFDC-4202 insulation promises superb extrusion processing characteristics and enhanced strippability for easier of field accessory installation.

NEXANS
www.nexans.com

New Hammond Mfg HJ H metal enclosures



Hammond Manufacturing has introduced its HJ H Series, a family of hinged cover metal enclosures, environmentally sealed to NEMA Type 3R, 4 (IP66), 12 and 13. Designed for wall or bulkhead mounting, the HJ H Series is designed for housing electrical and electronic equipment in installations where dust and/or water protection is required. An initial 27 sizes are available, ranging from 4 in. x 4 in. x 3 in. to 16 in. x 14 in. x 10 in. Top and bottom mounting flanges on industry standard centres are provided as standard on all sizes. The body of the unit is fabricated from 16 or 14-gauge steel, the covers from 14-gauge, powder coated in ANSI 61 gray.

HAMMOND MANUFACTURING
www.hammondmfg.com

MISSISSAUGA OCTOBER 17, 2013



ELECTRICAL MAINTENANCE & RELIABILITY

YOUR OPPORTUNITY TO LEARN VALUABLE INFORMATION AND NETWORK WITH INDUSTRY PEERS.

Speakers include:

Martin Robinson, I.Eng.

"Why we MUST Consider Performing a Complete Electrical Maintenance Program"

This presentation will demonstrate the need for a multiple-technology approach when considering the health and reliability of the lifeblood of a company: the electrical distribution system.

Terry Becker, P.Eng.

"The Electrical Safety Trifecta"

One must do everything possible to reduce the risk of worker exposure to the hazards of electrical arc flash and shock.

Ken Bannister

"Meeting the electrical safety plan challenges required by CSA Z462"

Explore innovative ways CSA Z462 can be used to complement and bolster the corporate maintenance approach, while simultaneously easing the pain of implementation and better assuring compliance sustainability.

VISIT www.PartnersInTraining.ca for complete content and speaker bios.

Early bird deadline is September 30!

For more information, visit: www.partnersintraining.ca



From the publishers of



ADVERTISER INDEX

ADVERTISER.....	PAGE
A-D Rewards	32
Arlington Industries	27
Banvil 2000	19
Bemag Transformer	8
Bluebook	29
Canadian Standards Association.	26, 30
Conec.	25
ElecDirect.com	17
Electricity Human Resources Canada . . .	22
Falvo Electrical Supply.	29
FLIR Canada	6
Fluke	29
GM Canada	15
Hammond Manufacturing	20
Hubbell Canada	24
Humber College	18
IPEX Electrical	2
L. Stoch & Associates	29
Mercedes Benz	11
Mersen	31
Nexans	1
Northern Cables	7
Ontario Power Authority	12
Partners In Training	28
Stanpro Lighting Systems	23
Thomas & Betts	1,5
United Wire & Cable.	4
Venture Lighting.	21
Visa	13



**Stoch
Spotlight**

on Engineering Services:

- Electrical Utility Audits
- Professional Development & Training
- Electrical Fire & Accident Investigations
- Quality Management Consulting & Auditing

L. Stoch and Associates
 Mississauga, Ontario, Canada
 Tel: (905) 828-2262 Fax: (905) 828-2526
 Email: info@lstoch.ca
 Website: www.lstoch.ca



FLUKE®

**Fluke CNX™
Wireless System
now includes Fluke
Thermal Imagers**

Capture measurements wirelessly.
Work smarter, faster, safer.

FIND IT. FIX IT. FAST.

flukecanada.ca/CNX

WANTED

**Molded Case Circuit Breakers.
New & Used, All Brands.
Motor Control & MCC.
Buckets in A&B, S.D. & W.H. & C.H.**

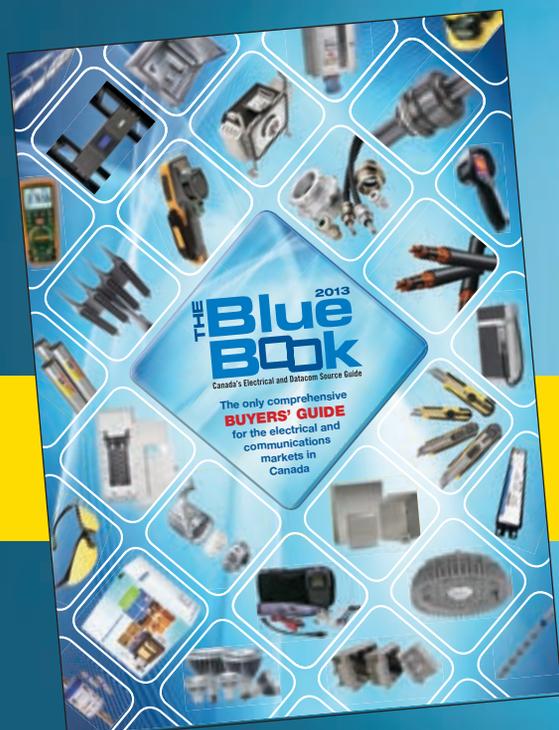
Please call, email or fax Ralph Falvo with your list.

FALVO ELECTRICAL SUPPLY LTD.
 5838-87A St., Edmonton, Alberta
 1-800-661-8892
 780-466-8078 Fax 780-468-1181
 email: rjf@falvo.com

Visit **WWW.
EBMag.com**
 and click the icon for our
DIGITAL EDITION!



LOOK FOR THE 2014 EDITION COMING THIS JANUARY!



THE Blue Book 2014

Canada's Electrical and Datacom Source Guide

Find the products and suppliers you are looking for with the **2013 BlueBook Buyer's Guide issue** and online at www.ebmag.com

Manufacturers & Suppliers can set up and update **FREE** listings at www.ebmag.com



Polarity identification for PV system conductors

The number of solar photovoltaic (PV) installations has been on the rise during the last few years; with increasing quantities, adverse incidents related to these types of installations are more likely to occur. However, learning from these incidents is prudent for improving designs, and developing better technologies and safer work practices.

In Ontario, a couple of fires resulted when the polarity of PV source and/or output circuit DC wiring was accidentally reversed during installation. One of the main contributing factors was the lack of marking and/or improper field marking of conductors, which present many opportunities for errors and, consequently, dangerous failures.

The failures are suspected to have been caused by increased potential when a single array's wiring was reversed to a combiner box. Minor contaminants such as moisture or dirt have started self-sustaining DC arcing faults—even with overcurrent protection in the Open position.

Unlike traditional AC systems (where connecting incorrectly identified conductors will cause the reversal of motors or an overcurrent device to operate), the reversal of

DC sources can create series circuits that will produce voltages well in excess of the rated system voltage.

The rated system voltage is used to determine the voltage ratings of cables, disconnects, overcurrent protection and other equipment in PV source or output circuits. When voltages exceed the ratings of any device, it will most likely cause its failure.

In recognizing this potential safety risk, Ontario's Electrical Safety Authority (ESA) submitted a proposal to Section 50: "Solar photovoltaic systems" of the Canadian Electrical Code (CEC) to address polarity identification for DC system conductors. Recently, the proposal was accepted by the Part I committee.

The new rule will require the DC PV output and source circuit conductors installed between a PV module and the power conditioning unit (e.g. inverter) of the DC system to be coloured, coded or both. The identification can be by printing (e.g. pos/neg or plus/minus symbols) or a solid colour (Red for positive, Black for negative). This new requirement will become mandatory when the 2015 CEC edition is published and

adopted by the provincial authorities having jurisdiction (AHJs).

CSA C22.2 No. 271 for PV cables requires the positive or negative identification on RPV or RPVU multi-conductor cables. Identification is optional for single-conductor polarity in the standard; however, when used, it is required to be in the same manner as multi-conductor cables.

While there are still a couple of years before the 2015 code is published, designers, engineers and contractors are encouraged to start using coloured and/or coded conductors for the DC PV circuits to minimize the potential of deleterious incidents and enhance the safety of workers during PV installation. **EB**

Nancy Hanna, P.Eng., is the engineering manager for Codes & Standards Department at Electrical Safety Authority (ESA) where, among other things, she participates in the development of bulletins, guidelines and technical communication concerning code interpretation and consistency issues. She is a LEED Accredited Professional, and is a member of several CSA TSCs for CEC Part 1, including Sections 24, 32, 46, 50 and 64. Nancy can be reached at nancy.hanna@electricalsafety.on.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 October'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

When receptacles of configuration 5-20RA are installed exposed to the weather and facing downward, at an angle of 45 or less from the horizontal, wet location cover plates may not be required.

- a) True
- b) False

Question 2

Motor disconnecting means shall not be of a type that is electrically operated either automatically or by remote control.

- a) True
- b) False

Question 3

For high voltage outdoor installations, horn-gap switches shall be mounted in a vertical position and be capable of being locked in the open position.

- a) True
- b) False

Answers: EBMag August 2013

Q-1: What is the maximum continuous load permitted on a service switch if marked for continuous operation at 100% and is supplied by single conductor cable in free air?

- c) 85%. Ref. Rule 8-104(4).

Q-2: The radius of the curve on the inner edge of bends made on smooth aluminum-sheathed cable shall be not less than [] times the external diameter of the sheath for cable not more than 19mm in external diameter.

- b) 10. Ref. Rule 12-712(2).

Q-3: For general power and lighting circuits, the maximum rating of overcurrent protection for No. 12AWG Aluminum conductor is:

- a) 15A. Ref. Rule 14-104(2).

EB CAREERS Looking for a new career opportunity? Look no further than **EBMag.com**. Visit our online "News" section to find the latest postings.

Always consult the electrical inspection authority in your province/territory for more specific interpretations.



New One-Day Training to Ensure Safe Installations in Hazardous Locations (Hazloc)

Based on the 2012 Canadian Electrical Code, Part I, this course explores the attention to detail required to ensure safe electrical equipment installation in Hazloc environments – from wiring methods to equipment selection.

Dates are scheduled across Canada this fall. VISIT SHOP.CSA.CA OR CALL (877) 670-2486





*Reduce wire
installation
time up to
75%*



Mersen USG Series UltraSafe™ Fuseholders

Innovative UltraSafe class CC and midget fuseholders with screw-less, spring pressure, wire termination technology.

ep-ca.mersen.com

MERSEN
Ferraz Shawmut is Mersen



IED Rewards
has made a
change.



IS NOW



Our name may be new, but all the things you love about us haven't changed at all.

You'll find the same great selection and quality rewards, the same exclusive promotions and the same amazing prizes you've come to expect from the best rewards program in the industry.

NOW, WITH EVEN MORE BRANCHES ACROSS CANADA TO SERVE YOU!

Get the things you've been *wishing* for.

ADRewards.ca

