

Electrical Business

SEPTEMBER 2012



PM # 40065710 Return Undeliverable Canadian Addresses To Circulation Department P.C. Box 530, Simcoe ON N3Y 4J5

Doing electrical distribution proud

■ Also in this issue...

- Considering commercial rooftop solar
- LED solutions at Marriott HQ
- Testing enterprise fiber

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Competition is never a bad thing; it encourages strategic thinking, innovation and leadership...

Doing electrical distribution proud

When I first got into this industry eight years ago, a lot of the electrical distributors with whom I spoke complained (or were worried) about big box stores moving in on their turf. There were also complaints from electrical contractors, too, ranging from how can electrical distributors be allowed to sell product to non-qualified customers to how can big box stores be allowed to encourage/enable customers to do their own work by selling electrical product.

I cannot speak to the complaints from electrical contractors except to say that it's our joint responsibility to educate the market on the benefits of hiring qualified persons to do our electrical work rather than do it ourselves. However, on the issue of electrical distributors worried about big box stores, I am pleased to report that—from what I can see—that concern proved immaterial, and those with the right business fundamentals in place are doing quite well, thank you very much.

All I need do is look at a few examples of distributors I have visited in the last little while who appear to not only have embraced big box competition, but have learned a few things from their competitors, too.

I specifically refer to my visits with Torbram Electric in Calgary, Alta.; Nedco in Mississauga, Ont.; and Osso Electric (Sonepar Canada) in Oshawa, Ont. (on the cover). What I see at all three locations are glistening, well-laid-out distributorships that evoke feelings of cleanliness, organization, professionalism, expertise, etc.—not unlike a retail outlet that goes out of its way to achieve those exact same feelings in regular consumers with its store design.

And when you add to the mix the fact that our electrical distributors extend credit, cultivate excellent supplier relationships (i.e. counter days) and, generally, know a hell of a lot about the products they sell and to whom they are selling, it is clear they are more than holding their own against the big boxes.

If you haven't visited your local electrical distributor in a while, I suggest it's high time you did. In closing, competition is never a bad thing: it encourages strategic thinking, innovation and leadership, and raises the bar for us all... tenets we can all follow, regardless of our discipline. **EB**

Anthony Capkun



On the cover

Osso Electric Supplies' Oshawa, Ont., branch has moved into its new location at 361 Marwood Drive after 28 years at its 209 Bloor Street location. True to their word, the new location allows for more inventory, more services and more parking.

Photo A. Capkun.

Contents

14 On the performance of arc flash analysis in DC power systems

With a better understanding of the DC circuit parameters and the DC capabilities of fuses, modelling DC arcs and selecting appropriate fuses for mitigating arc flash hazard can be accomplished without much difficulty. The proposed procedure allows evaluation of incident energy and arc flash boundaries while taking into account as many circuit parameters as possible.

20 Enhanced electrical safety in the workplace

As manufacturers of electrical equipment, system designers and installers, we are accustomed to continuously improving our products, designs and practices to be more productive. However, we must also keep improving the level of protection and safety provided for those that operate and maintain electrical systems.

22 Thermal imaging cameras find hot spots in data centre preventive maintenance programs

Infrared (IR) thermography is an important sensing technology that helps identify problems that could impact a data centre's energy performance and operations. When facilities consume mass amounts of energy, it is imperative that the primary power supply

is regularly monitored, not just for energy efficiency gains but to ensure reliability of overall operations.

26 How to meet today's challenges in testing enterprise fiber

Maintaining tomorrow's fiber network with yesterday's troubleshooting tools is a recipe for frustration, if not disaster. Sound familiar? To understand what you need to know, let's look back at the changes data centres are undergoing, and the implications these changes have on fiber testing requirements.

30 LED lighting brings new radiance, energy savings to Marriott HQ

How much money and energy can you really save from simply installing LED solutions? Several locations at Marriott International's headquarters recently enhanced its lighting systems with a number of LED bulbs to improve energy efficiency and enrich lighting quality.

32 What you should know before investing in commercial rooftop solar

Deciding if you should invest in utility-scale rooftop solar? Whether you are an investor or commercial building owner, it's all about doing your homework. Here are some questions to consider before taking on the project.

DEPARTMENTS

- 4 Letters
- 5 Industry News
- 10 Personalities
- 11 Calendar
- 12 Mind Your Safety
Maintain your equipment; reduce your risk (Part 6)
- 35 Products & Solutions
- 38 Code File
Inductive heating in metallic enclosures
- 38 The Code Conundrum

page 35



page 32



page 30



page 14



page 20



page 22



page 26





✉ B.C. gets serious about privacy theft?

(This comment comes to us from a news item we posted online July 24, 2012, "British Columbia gets serious about cable and metal theft". You can read the full item here: bit.ly/N1wvfu — Editor)

Another slippery slope; if police have a need, they should get a warrant. Lazy policing at its worst combined with knee-jerk government. Live on your knees, sheeple.

— SmarterThanYou

Electrical Business

September 2012 • Volume 48 • 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.

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

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

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

Printed in Canada
ISSN 0013-4244

CIRCULATION: Karen Thomson
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SUBSCRIPTION RATES:

Canada: Single issue \$7.00
12 issues: \$35.00 (includes tax)

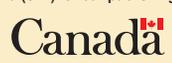
USA: \$59.00 (US)

International: \$75.00 (US) per year

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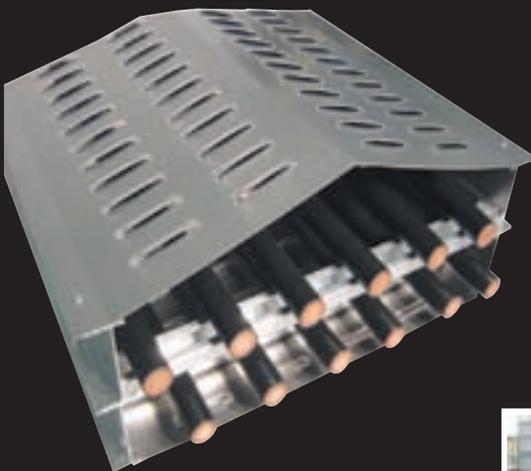
We acknowledge the financial support of the Government of Canada through the Canada Periodical Fund (CPF) for our publishing activities.




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Who were Canada's safest employers this year?

Canada's Safest Employers 2012 (www.safestemployers.com) recognized 13 Canadian organizations for their outstanding achievements in promoting workplace health and safety. Winners from five categories were honoured as Canada's safest employers at a gala event in Toronto, Ont., on September 6. Among those winners were:

Building & Construction

Pronghorn Controls, Gold (www.pronghorn.ca)
Hatch Mott MacDonald, Silver (www.hatchmott.com)

Transportation & Utilities

Peterborough Utilities Group, Gold (www.peterboroughutilities.ca)
PowerStream Inc., Silver (www.powerstream.ca)

ESC Career Focus Initiative pays YOU to jumpstart next generation

The Electricity Sector Council (ESC, www.brightfutures.ca) says it has worked with employers by assisting them in hiring post-secondary technician, technologist or engineering graduates since 2005. The incentive is back, says ESC, and being offered to all 19 electrical occupations as listed in ESC's 2011 LMI (labour market information) report.

Through the ESC's Career Focus Initiative, the council says it has assisted over 40 employers and provided over \$834,000 in subsidy money.

The initiative was developed to provide career-related work experiences to young post-secondary graduates to increase their employability skills and facilitate transition into the labour market. The program also aims to assist Canadian employers through financial support so they may benefit from introducing highly skilled young people to their workplaces.

The initiative offers up to \$12,500 per candidate. To qualify for the subsidy, host companies/employers must:

- Guarantee a minimum of 30 hours of work per week in a full-time position.
- Provide \$1 in wages for every \$1 of subsidy funding received (max. \$12,500 per candidate available).
- Must have nepotism policy in place.

- Develop a formal learning plan i.e. personalized action plan, between an employer and a participant, designed to help set and meet work-related learning objectives.
- Have completed the wage subsidy application and have the employer wage subsidy contract in place before the candidate starts work.
- Be an electricity/renewable energy employer.

For a participant hire to qualify, they must:

- Have graduated as a technician, technologist,

engineer, electrician, powerline worker, power systems operators or any of the 19 electrical occupations listed in the 2011 LMI report.

- Be between the ages of 15 and 30.
- Be a new hire (not an existing employee).
- Be a Canadian citizen or have landed immigrant status.

To learn more or apply for funding, contact Leigh-Anne Donovan at donovan@brightfutures.ca or (613) 235-5540 ext. 237.



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Extended producer responsibility - EPR - programs in Quebec



A couple of new programs for the recovery and reclamation of products in the Province of Quebec—in keeping with the principle of extended producer responsibility (EPR)—involve mercury-containing lamps (e.g. fluorescent tubes and compact fluorescent lamps [CFLs]) and chargeable and non-rechargeable batteries.

For chargeable and non-rechargeable batteries, the nearest drop-off centre can be found by visiting appelarecycler.ca.

For mercury-containing lamps, the nearest drop-off centre can be found by visiting recyclefluo.ca.

Leviton acquires Home Automation



Leviton Manufacturing Co. (www.leviton.com), a global manufacturer of electrical devices, announced the acquisition of Home Automation Inc. (HAI, www.homeauto.com).

Incorporated in 1985, HAI offers various automation products, including home control systems, programmable communicating thermostats, smart light switches, and software that allows access and control of an automation system over the internet.

HAI enhances Leviton's current home automation offerings by providing "homeowners with solutions that combine security, energy management and entertainment controls, in user-friendly applications", said Leviton.

HAI will operate as a new, standalone business unit, branded HAI by Leviton, and maintain operations in New Orleans, La. The new business unit will be managed by Jay McLellan, current CEO and president of HAI, who will report directly to Daryoush Larizadeh, COO of Leviton.

"Leviton's acquisition of HAI represents a significant expansion of our offerings in the residential market, and furthers Leviton's commitment to providing customers with the latest technologies as affordable, easy-to-use solutions," said Daryoush Larizadeh, COO of Leviton.

"We are proud to be part of the Leviton team, joining a company with a rich history and well-established brand," added McLellan.

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Government of Canada says it has reduced red tape for small business

The Government of Canada says it recently introduced a number of initiatives to reduce the red tape small businesses face. For example, Economic Action Plan 2012 extended the Hiring Credit for Small Business (bit.ly/o9Xuaa), which helps offset the cost of hiring new employees, and will be automatically applied when a qualifying business files its 2012 T4 information return. Canada Revenue Agency (CRA) will calculate it for you, no added burden.

Also, the new My Business Account (bit.ly/TkfACc) Enquiries Service provides businesses (or their representatives) with a secure, online portal to ask CRA tax-related questions specific to their accounts. Businesses then receive answers upon which they can rely in the Message Centre—online and in writing.

Since January 2012, businesses can file up to 50 information returns in a single submission using CRA's Web Forms application. CRA also recently created a one-stop shop webpage where businesses can find information and service options that may apply to their situation: www.cra.gc.ca/businessonline.

CRA also changed the penalty structure (bit.ly/TkfDxU) that is applied for failure to file an information return by the due date for some small businesses. The new administrative structure, which applies to specific information returns, has lowered the penalties for businesses who file fewer than 11 slips. For example, those filing one to five qualifying returns will have a maximum penalty of \$100 under the new structure as opposed to \$1000.

Discussing those changes today at a meeting of Nanaimo, B.C.'s local business community were parliamentary secretary to the minister of national revenue, Cathy McLeod, accompanied by James Lunney, MP Nanaimo-Alberni.

"Reducing red tape for businesses is one important way that we are putting the economy first and supporting small businesses," said Lunney.

Irwin asks you to thank skilled tradesmen on September 21

The second annual National Tradesmen Day will be held on Friday, September 21, 2012, and Irwin Tools encourages all Canadians to make plans to recognize Canada's tradesmen: the men and women who are the backbone of our nation.



"The country's skilled craftsmen should be proud of their incredible skills and talents. And they deserve to be recognized for their hard work, which is often performed in difficult environments under stressful conditions," says Irwin.

National Tradesmen Day—started by Irwin last year and held each year on the third Friday in September—is a day when the company would like us to pause and thank skilled workers like electricians and others who help keep Canada running.

"It's vitally important that we say thanks and find ways to encourage skilled trades as valuable career choices for young people," says the company. "Without these hard-working men and women, Canada's infrastructure and our way of life would come to a screeching halt."

Between 2012 and 2020, 219,000 workers are expected to retire, and not all of these jobs will be filled through expected workforce growth, Irwin reports.

This year, Irwin is coordinating multiple activities throughout the nation and is partnering with retailers and community groups for National Tradesmen Day celebrations. Visit www.nationaltradesmenday.com.

British Columbia gets serious about cable and metal theft



The Province of British Columbia has announced Canada's first provincial metal theft law and regulations with identification and reporting requirements designed to limit the resale market for stolen assets, and ensure thieves are identified and prosecuted.

"We have the first provincial law in the country that will remove anonymity and provide police with the kind of information they need to catch metal thieves," said Shirley Bond, B.C.'s minister of justice and attorney general.

B.C.'s Metal Dealers & Recyclers Act will build on bylaws long in effect in a dozen Lower Mainland communities, including Surrey, where metal theft remains a public safety concern with a multi-million-dollar tab

each year. Backed by regulations developed this year, the regulations are expected to significantly curb the sale of metals stolen in one community then sold elsewhere, where no local bylaw exists.

Those wishing to sell regulated metals on or after that date must present valid identification. In turn, scrap dealers and recyclers who buy these metals will share purchase details with their local police. Officers will be able to use this information to compare against reports of stolen metal and seek court orders to obtain further information from dealers when required.

"A collaborative response is required to effectively reduce wire theft. The province has developed an approach that limits the 'quick cash' aspect of wire theft, which will help deter thieves and ensure they're caught," said Dianne Watts, mayor of Surrey.

Thieves use a variety of methods to locate and steal wire and metal, says the RCMP. Some have posed as renovation contractors while stripping copper from vacant homes, while others have been known to use resources such as Google Earth to identify large amounts of metal (e.g. spools of wire) stored outdoors.

To continue reading this article, visit bit.ly/ME6Rd7.

Help Save Nikola Tesla's Wardencllyffe Laboratory!



"We need to raise the money to buy Wardencllyffe quickly. Looking for a substantial grant or donation to make this possible. Does anyone have some good connections to possible funding sources?"

This was posted Monday, July 30, on the Facebook page (on.fb.me/TkcY7v) of a not-for-profit organization called Tesla Science Center at Wardencllyffe (a.k.a. Friends of Science East Inc., www.teslasciencecenter.org), which aims to raise \$1.6 million for the Wardencllyffe property. Owned by Agfa, the property includes the original Tesla building, and the concrete and granite tower foundation.

The group wants to develop a regional science & technology centre on this site in Shoreham, N.Y., which would include: visiting experts, presentations and lectures; science teacher association conferences and symposia; a Tesla exhibit; exploratorium-type exhibits; a possible incubator space and more.

"The historic significance of the Shoreham site presents a unique opportunity as it contains the only remaining laboratory where Nikola Tesla—the famous inventor of alternating current electricity and neon lighting—conducted research," says the organization on its website.

Visit www.teslasciencecenter.org or email info@teslasciencecenter.org and help save Wardencllyffe.

Ontario expands Aboriginal Loan Guarantee Program for energy projects

Ontario is expanding the Aboriginal Loan Guarantee Program to "encourage First Nation and Métis participation in the province's clean energy economy", make an additional \$150 million available under the loan program.

To date, the program has received applications totalling \$250 million for projects that are expected to bring over 600MW of renewable energy online, and create up to 2800 new jobs.

The Aboriginal Loan Guarantee Program provides loan guarantees of up to 75% of an Aboriginal community's investment in an eligible project, helping to make borrowing money to buy equity in eligible projects more affordable for First Nation and Métis communities, says the government. Ownership will help provide a community with long-term sources of revenue.

"This program is an important part of our plan for a strong and prosperous Northern Ontario," said Michael Gravelle, MPP for Thunder Bay-Superior North. "Working as partners in land and resource development, we are unlocking Ontario's clean energy potential and creating real and lasting opportunities for First Nation and Métis communities."

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FortisBC selects Itron as advanced metering solution supplier



FortisBC Inc. (www.fortisbc.com) has selected Itron's smart grid solution—consisting of advanced metering, network

communications and software systems—to support the utility's advanced metering infrastructure (AMI) project. The solution will enable FortisBC, an integrated energy solutions provider serving about 162,000 electricity customers in the southern interior of British Columbia, to modernize its electrical grid.

The project, which still requires approval from the British Columbia Utilities Commission, includes 115,000 Itron advanced meters operated over a multi-application IPv6 communication network based on Cisco's GridBlocks architecture. In addition, FortisBC will install Itron's meter data management and data presentment software for the processing and analysis of meter and other utility-related data. The contract is worth about \$21 million, and installation is expected to be complete by the end of 2015.

"At FortisBC, meter reading has largely been a manual process. Itron's smart grid solution will help us build a more secure and reliable grid, enabling key programs for consumer engagement and grid efficiency," said Mark Warren, director of customer service at FortisBC.

The smart grid solution will allow FortisBC to implement consumer engagement programs and give utility customers greater control of their energy use, says Itron (www.itron.com). Moreover, with capabilities such as outage notification and theft detection, FortisBC will realize operational savings and greater system efficiency.

The ONLY electrical workshop of its kind in North America - CANEW

Electrical Business caught up with Murray Ames, Campbell River airport electrician and director/treasurer with CAEA (Canadian Airport Electrical Association), to get the latest on the upcoming Canadian Airports National Electrical Workshop (CANEW, www.canew.ca/canew_2012.htm) 2012, September 24-28 in St. John's. And EBMag will be there!

"The St. John's Airport and their staff have been great to work with, and have been a major sponsor and supporter for this year's workshop, which will add greatly to the overall experience and success of the event," says Ames.

Workshop organizers say they have secured a tour of the area around St John's with a local tour company for Sunday, September 23, for people coming in before the start of the workshop. Tours and events have also been organized for the spousal program from Monday through Thursday.

"Our registrations numbers look very good at this time, with delegate and tradeshow both above-average for this time of the year," says Ames, adding that additional sponsors—especially from Canadian airports—are always welcome. "All funds come from delegate and tradeshow registration and sponsorship to support the workshop. CAEA tries to keep the delegate costs as low as possible so that even small airports can send their personnel."

For the first time, CAEA and two of its suppliers will provide two hands-on training courses during the workshop at no additional cost to the delegates who take them. "Participants will receive documentation showing their participation, which will benefit both them and their airports for training and safety," notes Ames.

The two courses are high-voltage splice kit use and precision approach path indicator (PAPI) system commissioning and maintenance. "These courses cover two very important and unique types of



equipment used on airports in Canada that require specific skills," says Ames, adding that a large number of delegates have already signed up for both, proving their importance.

Some of the presentations lined up so far include:

- CSA Z463, airport maintenance section
- Power quality
- Airfield lighting maintenance
- Photovoltaic systems
- Grounding
- Power conservation
- Airport construction projects

"We are also working on our list of plenary topics that relate to airport electrical, and are discussed among delegates over the course of the workshop. The contacts you will make at CANEW will assist you in whatever airport electrical work you do," says Ames.

Electrical Business' editor, Anthony Capkun, will be there covering the workshop, so we hope to see you there, too. For more information, visit CANEW 2012, and support this worthwhile workshop—the only one of its kind in North America.

Rivers flowing into the sea offer great potential as electricity source

The latest episode in the American Chemical Society's (ACS, www.acs.org) Global Challenges/Chemistry Solutions podcast series describes a process that could pave the way for a new genre of electric power-generating stations; by tapping just 1/10th of the global potential of a little-known energy source that exists where rivers flow into the ocean, these stations could supply electricity for more than a half billion people.

Based on a report by Menachem Elimelech, Ph.D., and Ngai Yin Yip in the ACS journal Environmental Science & Technology, the new podcast is available for free at iTunes and from www.acs.org/globalchallenges. In the report, Elimelech and Yip explain that a process called pressure-retarded osmosis (PRO), which exploits the difference in saltiness

between freshwater and seawater. PRO requires no fuel, is sustainable and releases no carbon dioxide.

In PRO, freshwater flows naturally through a membrane to dilute seawater on the other side. The pressure from the flow spins a turbine generator and produces electricity. With PRO appearing to have great potential, the scientists set out to make better calculations on how much it actually could contribute to future energy needs under real-world conditions.

Elimelech and Yip concluded that PRO power-generating stations using just 1/10th of the global river water flow into the oceans could generate enough power to meet the electricity needs of 520 million people. The same amount of electricity, were it produced by a coal-fired power plant, would release more than 1 billion metric tonnes of greenhouse gases every year.

AECL concludes first public Open House in over a decade

Atomic Energy of Canada Ltd. (AECL, www.aecl.ca) reports over 2000 people attended its public Open House held at Chalk River Laboratories on August 11. The event gave the local community an opportunity to learn more about “Canada’s premier nuclear science and technology organization”, and some of the unique Canadian science facilities that call the Ottawa Valley home.

“I am enormously pleased that over 2000 of our friends and neighbours came out to attend the 2012 AECL Open House,” said Bob Walker, president and CEO of AECL. “This day took six months of planning and, in the end, I think we showcased some of the important science and technology work that takes place here at the Chalk River Laboratories. A big thank you must also be given to all of my colleagues who came out and helped today with display booths, gave tours and volunteered their time.”

Children spent time at the “Kids in Science” demonstration by Science North, where they took part in hands-on science experiments. There were also over a dozen heavy equipment vehicles on display, and families were able to dress up and pretend they were firefighters.

Last held in the summer of 2000, AECL’s Open House provides the local community a glimpse into some of the different programs and services that AECL undertakes on behalf of Canadians. After a brief orientation presentation, visitors were able to participate in walking tours of laboratories and facilities managed by different AECL departments, including the Mechanical Equipment Development, Inspection, Monitoring & Dynamics, Fluid Sealing Technologies and the Machine Shop.

Accubid founder Giovanni Marcelli acquires Northern Transformer

Electrical Business has learned Northern Transformer (www.northerntransformer.com) was recently acquired by Giovanni Marcelli, the founder of Accubid Systems (which was acquired by Trimble in 2010, bit.ly/NYytZ8).

The whole leadership, production and administrative teams that are part of Northern Transformer are still in place, augmented by Marcelli and new president, Justin Emmanuel (who was part of Accubid’s executive team). “Giovanni and Justin possess the experience and expertise to take Northern Transformer to the next level and better serve the market,” reads the information we received.

Over the coming year, significant investments are planned to modernize and expand Northern Transformer’s production facilities. “Our mission is to take great care of clients and produce very robust transformers,” continues the press release.

“Best wishes to Bill Kemp on his well-deserved retirement, and a sincere and profound thank you to all clients,” concludes the press release. **EB**

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Wayne Edwards

Electrical Business has learned that **Wayne Edwards**, VP sustainability & electrical safety with **Electro-Federation Canada** (EFC, www.electrofed.com) has taken on the position of chair for the **Canadian Anti-Counterfeiting Network** (CACN, www.cacn.ca) for a two-year term. CACN is a coalition of individuals, companies, firms and associations united in the fight against product counterfeiting and copyright piracy in Canada and internationally—an important battle affecting our industry.



Charles G. McClure Jr.

General Cable Corp. (www.generalcable.com) announced **Charles G. McClure Jr.**—chair, CEO and president of **Meritor Inc.**—resigned from the board of directors, citing personal reasons “as a result of demands relating to ongoing business activities, and not due to any disagreement with the company”. “Chip McClure has made valuable contributions to the board of directors and the company during his board service, and we are grateful for the perspective and insights he has brought in many areas,” said General Cable chair **John E. Welsh III**. The company says it plans to fill the vacancy created by McClure’s resignation.

Michel Beaumier has joined **Liteline Corp.** (www.liteline.com) as regional sales manager Eastern Canada. Beaumier has a diploma in lighting technology from André Grasset College and most recently worked at Hubbell Lighting Inc., also as regional sales manager for Eastern Canada. Beaumier previously worked with Guillevin International, Roy Marchand Inc., Canlyte and

Peerless Electric. “I am very happy to be joining Liteline and enthusiastic about what I can bring to the organization, and where we can go together,” he said.

Brian Power, VP sales of **Techspan Industries** (www.techspan.ca), announced the return of **Jorge Roman** to the position of regional sales manager for Southwest and Northern Ontario. Roman is responsible for servicing and managing relationships with Techspan’s distributor accounts in the region, as well as developing end user and contractor accounts for the Techspan brand. Roman has almost 20 years of experience in the industry, including extensive sales experience with Techspan and others.



Erol Kirilmaz

Erol Kirilmaz has taken charge of worldwide sales for **Osram** (www.osram.com)’s largest business unit, General Lighting. In his last post, Kirilmaz was responsible for Osram business in Latin America, the Middle East and Africa. “In Erol Kirilmaz, we have gained an absolute professional with many years of experience in international sales, particularly in very fast-growing developing countries around the world,” said **Klaus-Günter Vennemann**, CEO of Osram’s General Lighting business unit. Kirilmaz succeeds **Alfred Felder**, who will be taking up new challenges outside of the company. In the last 20-odd years, Erol has performed various functions, mainly in connection with sales; first at Siemens, then at Osram (www.osram.com). Osram AG’s General Lighting business unit was formed when the Professional and the Consumer Lighting divisions were combined last year.



Peter Bellingshausen

Shelli Sedlak, specification engineering team manager at **GE Lighting** (www.gelighting.com), has announced **Peter Bellingshausen** as the newest addition to the GE Lighting Professional Sales team as Lead Lighting Sales - Specification for the Greater Toronto Area (GTA), Ont. Reporting directly to Sedlak, Bellingshausen is based at GE Canada’s Canadian head office in Mississauga, Ont., and will represent and support the complete range of GE Lighting Professional Solutions - lamps, ballasts, drivers, controls and LED system products - to the GTA specification market. GE Lighting describes Bellingshausen as bringing “strong specification sales and relationship building experience and is well known in the specification community”.

Corning Inc. (www.corning.com)’s board of directors has elected **Martin J. Curran** to the position of senior vice-president and innovation officer—a new position in the company. Most recently, Curran served as senior vice-president and general manager, Corning Optical Fiber. Meanwhile, Corning Inc.’s board of directors has elected **Clark S. Kinlin** to the position of executive vice-president, Corning Telecommunications business group. The group comprises Corning Optical Fiber and Corning Cable Systems (www.corning.com/cablesystems). The board also elected **Stephen P. Miller** as vice-president and general manager, Corning Optical Fiber and Cable, reporting to Kinlin. Most recently, Miller served as senior vice-president and CFO for Corning Cable Systems.



Dan Boucher

Schneider Electric (www.schneider-electric.com/ca) has appointed **Dan Boucher** utilities segment manager, Infrastructure Business for Canada, where he will be responsible for sales and marketing for the Canadian utility segment. He will also oversee engineering, operations, project management, and mergers and acquisitions on a national, North American and global basis. Boucher has more than 20 years of experience in the energy segment while working with some of the globe’s largest international power and automation companies, said Schneider. Boucher is a professional engineer, acquiring one of his engineering degrees at École de Technologie Supérieure (ÉTS) in Montreal, Que.



John Newman



Mike Smith

Ideal Supply reorganized its senior management team to “position the company for future growth” by appointing **John Newman** to the newly created executive position of lighting market manager, and **Mike Smith** to the senior role of Electrical Division sales manager. Saying that lighting has become one of its most important product groups for future growth, Ideal believes this group required a dedicated focus and strong leadership to drive key business growth initiatives. Newman has been with Ideal for 37 years and will be responsible for cultivating long-term strategic partnerships, increasing market visibility and generating new revenue streams. Smith has led Ideal’s Safety Supplies Division since 2010 in addition to managing the company’s sales efforts in clean energy and datacom. He will now lead the Electrical Division’s account managers in business strategy development and drive revenue opportunities. **EB**

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- VIDEO** • GE Lighting Tour provides a "value story" for customers and end users. Visit bit.ly/OTATkt.
- GALLERY** • EBMag hits the green at ECAO IBEW 7th Annual Golf Tournament in Ontario. Visit bit.ly/OTC2Si.
- VIDEO** • EBMag attends ECAA's 50th anniversary celebrations in Alberta. Visit bit.ly/R3Gi3v.
- GALLERY** • Osso Electric Supplies' Oshawa branch moves to Marwood Drive. Visit bit.ly/OTC4K6.

BCEA LightRecycle Expansion Program Breakfast Meetings
British Columbia Electrical Association
 Various B.C. dates/locations in **September**
 Visit www.bcea.bc.ca

EFC Ontario Region Breakfast Meeting
Electro-Federation Canada
September 14, Vaughan, Ont.
 Visit www.electrofed.com/newsroom/events

ESC Knowledge Management in Electricity (Certified Knowledge Manager Specialist Series)
Electricity Sector Council
September 17-19, Toronto, Ont.
 Visit www.kminstitute.ca/ckm
 (Use Code ESC0015)

EFC Economic Forecast
Electro-Federation Canada
September 20, Brampton, Ont.
 Visit www.electrofed.com/newsroom/events

IAEI Fall Convention
Canadian Section & Ontario Chapter, Int'l Assoc. of Electrical Inspectors
September 21-23, Toronto, Ont.
 Visit www.iaieicdnconvention.org/fall.htm

CAEA Canadian Airports National Electrical Workshop (CANEW)
Canadian Airports Electrical Association
September 24-28, St. John's, N.L.
 Visit www.canew.ca/canew_2012.htm

CIGRE Canada Conference
International Council on Large Electric Systems
September 24-26, Montreal, Que.
 Visit www.cigre.ca

59th PCIC Petroleum and Chemical Industry Technical Conference
IEEE Industry Applications Society (IAS), Petroleum and Chemical Industry Committee (PCIC)
September 24-26, New Orleans, La.
 Visit www.ieee-pcic.org

Nova Scotia Feed-in Tariff Forum
Canadian Clean Energy Conferences
September 24-25, Halifax, N.S.
 Visit www.amiando.com/nsfit2012.html

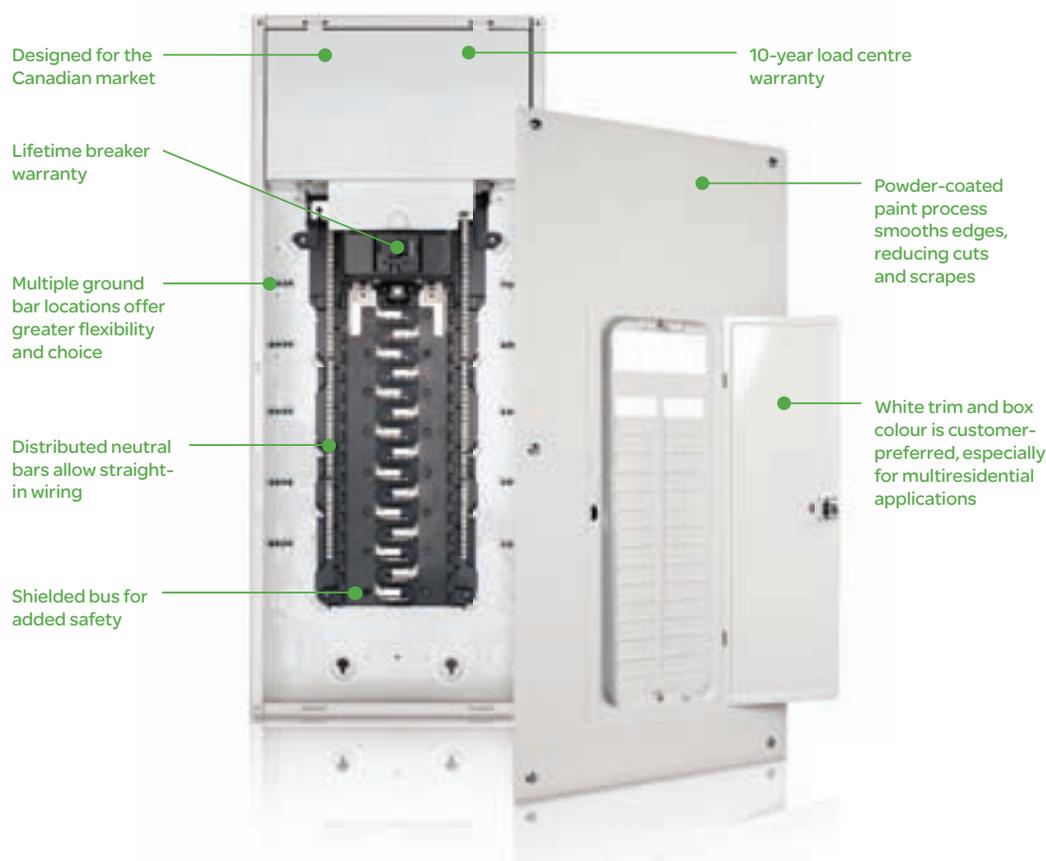
14th Annual IDEA E-Biz Forum
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September 25-27, Dallas, Texas
 Visit www.idea-ebizforum.com

Quebec Region Fall Activity (Activité Automnale)
Electro-Federation Canada
September 27, Montreal, Que.
 Visit www.electrofed.com/newsroom/events

NECA
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September 29-October 2, Las Vegas, Nev.
 Visit www.necaconvention.org

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Part six

In previous articles, I described standards developed by NETA (the InterNational Electrical Testing Association) and PEARL (the Professional Electrical Apparatus Recyclers League). One of the great difficulties over the years has been how to record all the information that is collected, and then use it effectively.

‘Effectively’ means being able to trend over time. With many tests, it is critical to go back historically and compare test results. Trying to access the documentation on a particular piece of apparatus from yearly tests over the previous years is time-consuming with paper-based forms, and it has always been difficult using them for trending and analysis.

ANSI/NETA “Standard for Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems” (2011) provides forms for recording the data that is gathered during electrical testing. (PEARL has been in the process of developing forms for several years to support its standards but, unfortunately, have not yet made them available.)

The leading edge of electrical maintenance has typically been utilities, but their standards and forms were customized specifically to their own systems and equipment. Many utilities were not willing to share them and, as they were often focused on systems over 69kV, these standards and forms weren’t often a good fit for 5-25kV systems even when they were willing to share. The forms from NETA heralded the first widespread availability of generic forms to industry.

It is a little-known fact that, when a company is servicing your electrical maintenance needs, they will offer you tests based on the equipment they possess; they may not offer or even mention tests requiring equipment they do not possess. Also, when a company does not have the equipment to do a particular test, they typically avoid creating an area on the form for capturing data they are not gathering... blank spaces would create confusion.

In our training classes, we occasionally hear the response, “Well, we never do that test!”, and then we walk the participants through the process of why they may not be performing a perfectly valid test commonly used by other firms.

In addition to NETA’s forms, several vendors provide electronic forms: ePowerForms, for example, offers “a suite of industry standard forms and software tools that speed data collection time, improves data consistency, and simplifies the data review process”. These forms were originally developed by American Electrical Testing, a Canton, Ma., NETA firm with numerous satellite offices.

The software was developed in-house at AET in the late 1990s when they discovered a need for electronic forms and, when other companies saw these forms and realized their ease of use, ePowerForms was created to sell product.

Megger, the test equipment manufacturer, also has software available called Power DB-Acceptance & Maintenance Test Data Management Software, which is “used for the collection and reporting of data from maintenance and inspection activities performed on equipment used in the generation, transmission, and distribution of electric power”. This software is designed to integrate with the Megger family of instruments as well as those from other test equipment manufacturers.

Software is far more effective than paper forms because it gives you automatic electronic capture of the data you’ve gathered plus—and more importantly—the trending, as well as a great deal of other information.

These suites contain forms that are not available in the NETA standards and are also somewhat different from the NETA forms. As you develop your own maintenance program, you will want to refer to both and review what your contractors are using to ensure you are aligned.

Software provides capabilities that are amazing, but remember: once the data is collected, the subjective analysis needs to happen. This is the grey area where expertise and experience can prevent catastrophe.

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

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

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On the performance of arc flash analysis in DC power systems

Michael Furtak and Lew Silecky

Direct current (DC) arcing fault incident energy calculations are presented to assess the level of risk involved when working around high-current DC apparatus, such as traction systems, public transportation, mines, battery packs, inverters, solar photovoltaic, wind farms, etc.

The proposed procedure allows evaluation of incident energy and arc flash boundaries while taking into account as many circuit parameters as possible. These parameters include fixed or variable gap length, electrode material, system voltage, available fault current, equipment configuration, circuit time constant and evaluated threshold energy for a second-degree burn.

DC arc steady state modelling

The resistance load line of the equivalent steady-state circuit diagram representing a linear DC supply can be described by Equation 1:

• Equation 1

$$V = V_s - I \cdot R_s$$

where V_s stands for open source voltage and R_s is system resistance, including source and feeders. Substituting into the Equation 1 voltage drop across an arc (V_{arc}), arcing current can be resolved as:

• Equation 2

$$I_{arc} = (V_s - V_{arc}) / V_s \cdot I_{sc}$$

where I_{sc} is prospective short-circuit current at the arcing point. It is shown that arc voltage is mainly determined by the arc length, and the voltage is within the 10-20V/cm range for arc currents up to the order of 50kA. Incident energy exposure for an open-air arc where the heat transfer depends on the spherical energy density is then expressed as:

• Equation 3

$$E_{inc} = V_{arc} \cdot I_{arc} \cdot t_{arc} / (4 \cdot \pi \cdot R^2)$$

where t_{arc} is the arc duration and R represents the distance from the arc. This formula assumes the radiant heat transfer. Not all of the arc energy will be transferred as radiant heat, especially within the short time interval after the arc is ignited. Therefore, Equation 3 will produce a conservative but safe estimate of incident energy exposure. For the arc in a box, the enclosure has a focusing effect on the incident energy. For the selected enclosure type and test distance, the incident energies calculated for enclosures are 2.2 times larger than the incident energies calculated for open air.

Written in terms of arc flash boundary, Equation 3 becomes:

• Equation 4

$$AFB = \sqrt{E_{arc} / (4 \cdot \pi \cdot E_t)}$$

where E_t stands for threshold incident energy to second-degree burn evaluated as:

• Equation 5

$$E_t = 1.2 \cdot t^{0.3}$$

DC arc transient conditions

The problem of determining the arc flash boundary becomes less trivial when gap is not fixed, and the distance between anode and cathode is anticipated to increase by separating the contacts. Also, the arc operates at the intersection of the arc volt-ampere characteristic curve and the resistance load line of the DC circuit. Therefore, the arcing current will stabilize itself at a fixed point on the curve, and the arc will dissipate a relatively constant amount of power.

continued on page 18

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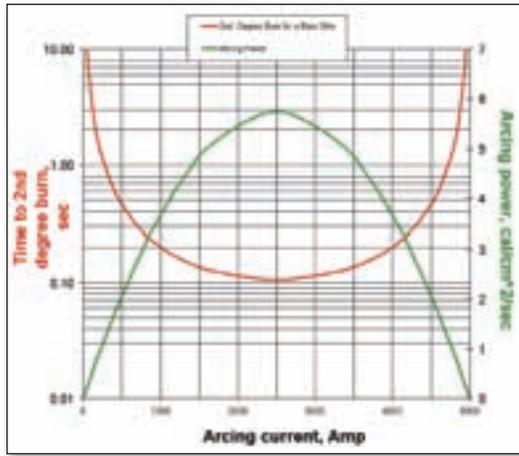


FIGURE 1
Sample arcing power and time to second-degree burn vs. arcing voltage and arcing current at 0.5-m distance away from arc in open air 600VDC system.

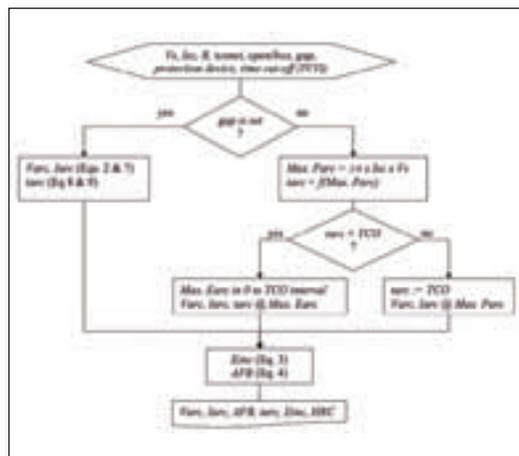


FIGURE 2
Simplified block diagram for resolving arcing faults in DC power systems.

However, it's hard to predict how long it will take for the arcing current to stabilize before the arc burns out or is cleared by the upstream protective device. The load line may intercept the characteristic curve in two locations, but only one point is stable. The stable operating location is the point with the lowest arc voltage.

Stokes and Oppenlander demonstrated that there is a minimum voltage needed to maintain an arc. That minimum depends on the current magnitude, gap width and orientation of the electrodes. This transitional point can be expressed as:

• Equation 6

$$It = 10 + 0.2 * Zg$$

where the length of the gap, Zg , is expressed in millimetres, and It is measured in amperes. Above that minimum, the arc $V-I$ characteristic can be expressed as:

• Equation 7

$$V_{arc} = (20 + 0.534 * Zg) * I_{arc}^{0.12}$$

To find the point where the arc $V-I$ characteristic crosses the circuit load line, solve Equations 2 and 7 using the iterative method. As the first approximation, assume V_{arc} is equal to half of the system voltage V_s .

Then, follow the steps below:

1. Determine I_{arc} from Equation 2
2. Substitute I_{arc} into Equation 7 to determine new V_{arc}

Cycle through the steps listed above until the answers for V_{arc} converge. Additionally, the circuit time constant affects current rise and protective device performance characteristics, thus impacting arc duration. In this case, the time current characteristic of the upstream protective device clearing the fault may have to be adjusted for the time constant.

When this occurs, the process of determining protective device operating time is cumbersome. First, the time-current characteristic of the protective device has to be analytically expressed as a function of the available fault current. A paper by Cynthia Cline provides an equation describing the relationship between the effective RMS current, the available fault current and the number of time constants:

• Equation 8

$$I_{rms} = I_{arc} * K$$

where the K factor is expressed in numbers of time constants $n = t_{arc} / t_{const}$:

• Equation 9

$$K = (1 + 2 * x * e^{-n} / n - e^{-2n} / 2n - 1.5 / n)^{0.5}$$

This creates a dilemma due to the fact that one cannot determine the arcing time without the RMS value of the arcing current, and one cannot solve for the RMS current without the arcing time represented by the n term in Equation 9. This requires an iterative solution.

As a first approximation, begin by assuming that I_{rms} equals I_{arc} , determining t_{arc} from the analytical expression for the fuse $T-C$ characteristics $t_{arc} = f(I_{rms})$, determining the number of time constants n and calculating K from Equation 9, substituting its value into Equation 8 to calculate the new RMS current, then solving for the arc duration again.

Once the first approximation of the arc duration has been made, determine the new number of time-constants n , recalculate the K term and substitute its value into Equation 8. This produces a new I_{rms} . Recalculate for a new t_{arc} by using the new I_{rms} and continue until the answers converge. Then, Equations 3 through 5 can be utilized to complete the DC arc analysis under the transient conditions.

Generalized solution

With numerous variable parameters on hand, which results in the difficulty to accurately model DC arc and to predict the arc $V-I$ characteristic and thermal behaviour, we decided to consider the worst-case scenario leading to an arbitrary burn hazard in the shortest possible time.

Figure 1 shows arcing power as a function of variable arcing current for the DC equivalent circuit described by Equation 1.

The red line on Figure 1 represents time to second-degree burn as a function of heat flux. Note that the minimum time to second-degree burn, as well as any other burn hazard, coincides with the maximum power released by an arc; hence, with maximum heat flux.

For a fuse with an inverse time-current characteristic, the amount of arcing current is inversely correlated with the fuse operating time and, consequently, the arc duration. With the decrease of arcing current, power released by an arc will actually increase and reach its maximum value corresponding to the middle point on Figure 1. Further decrease in arcing current will lead to a decrease in arcing power and an increase in arc duration time when it takes more time for the upstream protective device to clear the fault. Therefore, there is a minimum amount of time leading to a specified burn severity produced by any given DC arc, and, for the second-degree burn on bare skin, that time can be expressed as:

• Equation 10

$$t = [0.015 * I_{sc} * V_s / (\pi * R^2 * E_b)]^{-1.43}$$

where E_b is equal to 1.2 cal/cm²/s. Equation 10 assumes rectangular flash pulse, thus producing the minimum time to second-degree burn under the specified circuit conditions. It can also be applied for hazards other than second-degree burn by selecting a different E_b factor on the right side of the Equation 10.

When analytical expression for the protective device clearing the fault time-current characteristic is available, it is possible to examine power and energy released by an arc as a function of arcing current and arc resistance, and to determine maximum damage that can be caused by the arc during the selected time interval. A simplified block diagram on Figure 2 describes the proposed approach for calculating incident energies and for determining arc flash boundaries in DC power systems.

With a better understanding of the DC circuit parameters and the DC capabilities of fuses, modelling DC arcs and selecting appropriate fuses for mitigating arc flash hazard can be accomplished without much difficulty. The generalized solution presented in this paper considers the worst case scenario, effectively eliminating the need for accurately predicting arcing gap and arc resistance. **EB**

Michael Furtak is an application engineer with Mersen Canada, specializing in application of overcurrent and overvoltage protective devices in electrical distribution systems. Michael holds a B.Sc. in Physics and is a professional member of OACETT and IEEE. Lew Silecky is technical sales & marketing manager for Mersen Canada, and a 30+ year member of OACETT. He is also a technical committee member for CSA Z462, Part 1 representative for the LAEI for Canadian Electrical Code sections 14, 18 and 42, and an IEEE and NFPA member.

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Enhanced **ELECTRICAL SAFETY** in the **WORKPLACE**



GE Energy Industrial Solutions' Ajay Gupta, channels director for Canada, explains the overarching theme of GE's Electric Odyssey Tour 2012 is maintaining uptime while mitigating arc flash.

Marcelo Valdes

Today, improved industrial safety is as much about leadership as it is about designing, manufacturing and installing products that make electrical systems safer to own, operate and maintain. As leaders in our respective fields, we must challenge ourselves to pursue initiatives that enhance the safety of all employees, as well as improve productivity.

As manufacturers of electrical equipment, system designers and installers, we understand the power and versatility that electricity provides, whether it be for lighting our environment, moving our machinery, making our surroundings comfortable or keeping our key facilities operative. We are accustomed to continuously improving our products, designs and practices to be more productive. However, we also need to continue improving the level of protection and safety provided for those that operate and maintain electrical systems as well as those that work around them.

Manufacturers of electrical equipment make products as safe as possible while designers and contractors ensure they are installed in adherence with the latest codes and standards. However, we all must also think about how our products and designs make electrical systems safer. The industry consensus is that safety in the workplace is as much about product selection, system design and proper installation as it is about the product itself.

Other solutions besides PPE

Education, standards, training and incentives to design systems that are inherently safer are increasingly available to users of electrical equipment. Standards accord higher value to solutions that "eliminate the hazard" or "substitute less hazardous products and materials" than to solutions that rely solely on training and personal protective equipment (PPE).

Clearly, training and PPE are crucial to any properly managed safety program. However, they are not necessarily the stand-alone solution to enhanced electrical safety in the workplace. Technological innovations, driven by industry leadership and standards, are part of the answer. Manufacturers of electrical products, installers and system designers must not only adhere to these standards, but should also help create more stringent standards and support industry efforts to improve understanding of potential hazards, and how to control and mitigate them. Manufacturers must offer users at all levels (e.g. system designers, facility engineers) alternatives to create safer solutions. In addition, system designers must be prepared to offer their clients alternative designs that improve the long-term safety of their installations. In the long run, this becomes a win-win solution for electrical manufacturers, system designers and contractors, as well as for the users of these products and installations.

Emerging technology enhances employee safety and systems protection

Together, we need to define problems and needs in the electrical industry so we can prioritize the fulfillment of those needs. One of the greatest essentials for enhanced safety in the workplace is implementing new technologies and design systems. In some cases, the industry will need to change—both in user design and safety practices—to take full advantage of emerging technology.

This simple realization creates new opportunities for differentiated products and services that can better serve the growing focus on creating safer work practices. System designers must make the effort to stay abreast of changes and implement new solutions that better address these concerns.

Safer products and solutions: the economic advantage

As industry leaders, we need to make the business case for a safer work environment. We must herald the advantages of integrating safer products and solutions into our work environment.

Business, industry and government leaders must understand the economic advantage of selecting safer products and paying for safer systems, even when the economic advantage is not initially obvious.

Business decision-making requires quantifying benefits in financial terms over a defined period. Increased investment to prevent an event that happens infrequently is sometimes difficult to rationalize; however, it is crucial because the cost of a lack of safety is too high.

Inspiring new mindsets through training

Electrical manufacturers need to do more than make new and safer products, while designers and installers must do more than simply follow minimum code requirements. We must encourage the user community to create new mindsets. These mindsets should include decision-making about how to select and use products, implement systems and improve installation practices so that the development of new technologies and solutions is not impeded.

We must vigorously train and educate each other... users, product manufacturers, system designers and installers. Training and education should be comprehensive and ongoing to enable the entire industry to become increasingly more informed about electrical safety—how to improve it, and the value of improving it.

With an increased understanding of the sources of electrical hazards, how to mitigate them and how new product-based solutions are created, it becomes incumbent



THREE WAYS THE INDUSTRY CAN ENHANCE ELECTRICAL SAFETY IN THE WORKPLACE

1. Fund and support ongoing research. We must understand the sources of electrical hazards to expunge them from facilities.
2. Educate and become educated about electrical safety. Work alongside the user community to ensure the needed standards are created with the best possible content.
3. Ensure proper policy is enacted. We must all become active participants to ensure a balanced and practical policy is put into place to enhance safety for our workers.

upon manufacturers to expose users, designers and installers to innovative ideas and new knowledge in the industry.

The need for education is multidirectional and constant. This is where forums such as the IEEE Industry Applications Society's Electrical Safety Workshop (ESW) present a unique opportunity for all relevant communities to learn from each other in concentrated bursts of knowledge.

Additionally, policies, standards and laws have roles to play; however, they cannot be created within a vacuum. It is the industry—consisting of users, installers, designers and manufacturers—that has a vested interest in making sure these policies, standards and laws are as good as they can be. We need a system with balanced participation from all industry stakeholders to ensure a sufficient use of checks and balances.

We must actively take on that responsibility by ensuring the organizations of which are a part participate in the process wherever they can, whether that organization is NEMA, IEEE, NFPA, CSA, etc., or provincial/territorial legislatures. We must get involved. Standards such as the ones produced by IEEE working groups are not created by IEEE employee experts but by volunteer experts from the industry. Experts and committed volunteers put many hours of work into creating standards upon which the industry relies. This application of the industry's existing knowledge will help create a safer electrical industry. **EB**

Marcelo E. Valdes, P.Eng., is manager of application engineering and innovation for GE Energy's Industrial Solutions business. Marcelo has 35 years of experience in field service, sales, applications and product management within the power distribution and control industry. He is also chair of one IEEE working group and participates in various others in the areas of industrial applications and electrical safety.

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Thermal imaging cameras find hot spots in data centre preventive maintenance programs

Today's data centres are high-density environments, stacked with powerful equipment. As a result, there is a greater emphasis on condition monitoring and preventive maintenance strategies to avoid downtime. Infrared (IR) thermography is an important sensing technology that will help identify problems that could impact a data centre's energy performance and operations.

Data centres are increasingly a major part of our global economic infrastructure with growth being driven by virtualization and cloud computing, as well as by large internet content providers such as Google, Facebook and Yahoo. Data centre owners who have relied upon conventional maintenance in the past are today turning to preventive maintenance programs to ensure that critical elements of the data centre's power supplies and contained equipment are continually monitored. When facilities consume mass amounts of energy, it is imperative that the primary power supply is regularly monitored, not just for energy efficiency gains but to ensure reliability of overall operations.

Thermography provides the means by which ongoing preventive maintenance can be carried out. It enables engineers to inspect vital HVAC equipment, cooling systems, electrical switchgear, power distribution units

(PDU) and other electrical devices quickly and easily. Thermal imaging, or infrared thermography, visualizes and measures infrared radiation emitted from objects. This technology can therefore be applied in any application where the performance or condition of a component can be revealed by means of thermal difference.

What an IR camera shows

The amount of infrared radiation emitted by a surface depends on both its temperature and its *emissivity*. Surfaces that are good reflectors (e.g. polished metal) are poor emitters, while surfaces that are good emitters (e.g. human skin) are poor reflectors. The emissivity of a surface is the ratio of energy radiated by that surface to energy radiated by a black body at the same temperature. Infrared energy makes up one part of the electromagnetic spectrum.

The naked eye cannot see infrared energy because it is emitted from objects as heat, not as light. The hotter an object, therefore, the more thermal energy it emits. Infrared thermal imaging cameras provide a visual representation of IR energy emissions. Where quantitative information is required, the thermal camera can also provide accurate surface temperature values of the object being viewed. The images generated can then be saved for later analysis and report generation.



Electrical parts that are damaged or about to fail will emit heat. The thermal camera detects any excessive heat in relation to the ambient temperature. For data centre maintenance engineers, thermal imaging technology can help:

- check for loose or over-tight connections;
- identify overloaded components;
- evaluate uneven voltage distribution; and
- recognize failed or fatigued components within a distribution system without having to isolate circuits.

As an example, let's look at a specific component of a data centre's electrical infrastructure: switchgear. It is not unusual for switchgear to experience surges in current that can lead to connections working themselves loose. This problem can go undetected when relying on the naked eye to notice it. Poor connections can lead to loss of connectivity, overheating, fires and power outages—all of which would be potentially disastrous. Using thermal imaging, it is possible to identify hotspots within switchgear to detect potential problems, and allow the engineer to repair them.

The benefits of deploying thermal imaging to the data centre are significant. First, because it may be possible to avoid shutting down the facility to fix the detected problem, there is no disruption to normal operations. Second, regular monitoring with thermal imaging cameras to ensure the data centre's power distribution boards, isolators and automatic switching panels are in working order can help the business comply with regulations.

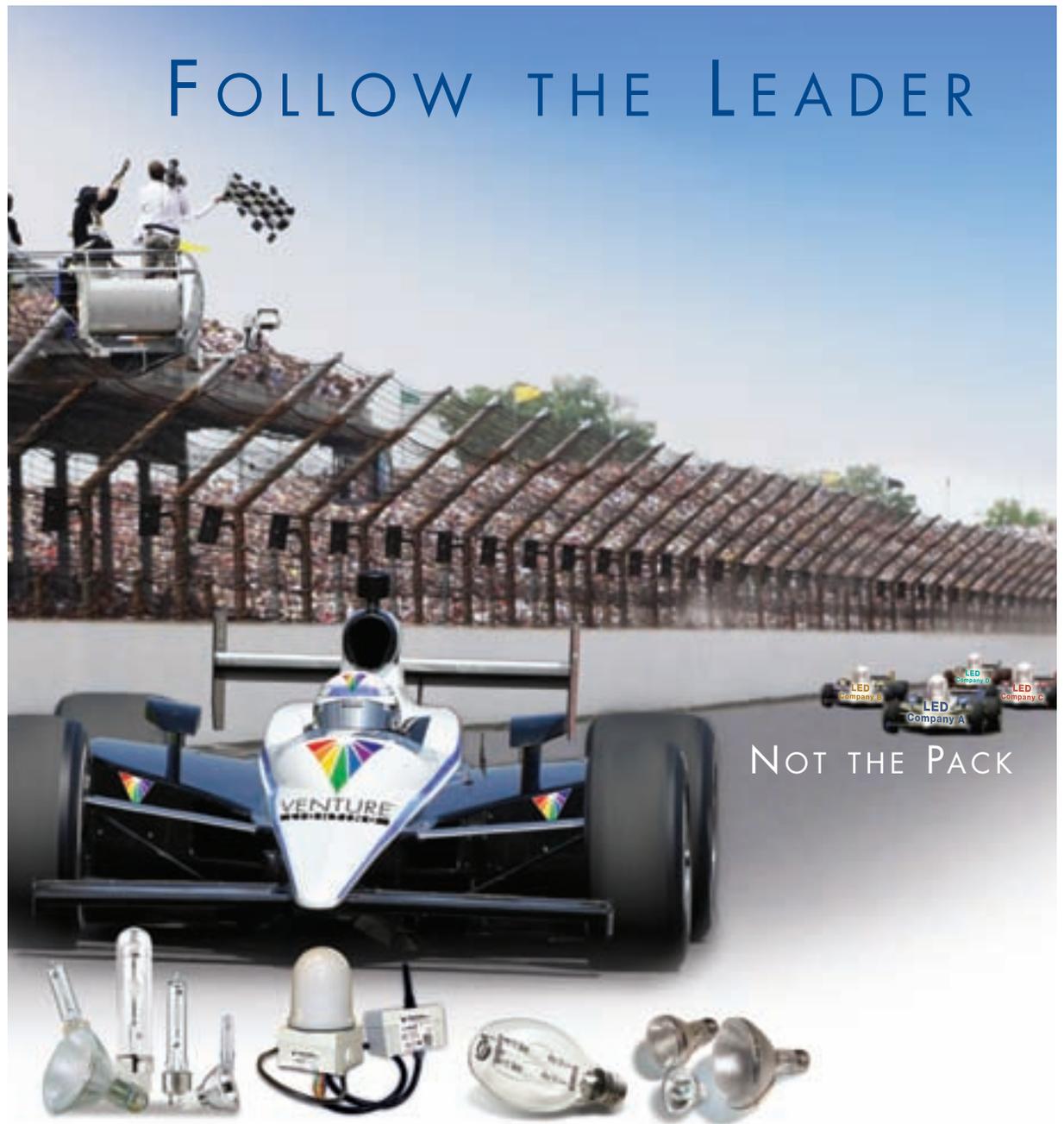
In addition, regularly checking the system will lead to better diagnosis of any problems and enable maintenance engineers to formulate a more effective plan of action to overcome issues. Also, the use of real-time data provided from regular monitoring can extend the life of the system and result in significant cost savings. By identifying the inevitable degeneration of power equipment, replacement activity can be planned at the optimum time, avoiding major disruption.

Infrared imaging for saving energy

Along with using thermal imaging for preventive maintenance, the technology offers significant energy saving benefits. Green issues are prominent in the data centre industry. Analysts estimate that the increased shift towards cloud computing will triple the information and communications technology sector's energy consumption by 2020.

Companies can achieve major cost savings by identifying areas where they are losing energy. Thermal imaging

can provide a complete picture of a building envelope and its energy performance or, more specifically, a particular zone, room or piece of equipment. For example, it is possible to scan computer rooms to identify problems like overloaded racks and power cables, or even when IT equipment is placed backwards and is blowing hot exhaust back into a cold aisle. This can have a dramatic impact on the efficiency of the cooling system. The same can be said for when cold air escapes under a rack where a brush grommet should have been placed.



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When thermal imaging is used to assess cooling systems and heat generating equipment it allows engineers to locate zones and the degree to which temperature-controlling units are actually cooling or heating the room. Systems then can be arranged for optimal performance, helping to increase the premise's energy efficiency and lower operational costs.

Enhanced ease-of-use coupled with lower prices have made thermal imaging cameras standard equipment for in-house maintenance engineers.

Where once a data centre would employ a specialist to carry out formal checks, in-house engineers can now do regular preventive maintenance and energy efficiency auditing themselves. In many cases, it only takes one problem to be identified and fixed for the thermal imager to pay for itself.

Infrared camera selection considerations

There are a number of key features to look out for when selecting a thermal imaging camera. Primarily,



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the quality of the image should be a major consideration. Owing to technological developments, it is now possible to find a device that delivers an exceptional high-resolution thermal image at an affordable price. Another important consideration is a detector that is fully *radiometric*, meaning it will capture temperature measurements over the entire image.

Image fusion allows the user to view the subject as either a digital or a thermal image, or a blend of both. By combining visible and thermal images, the user is able to get a clear image of the equipment being monitored while easily seeing potential faults.

Temperature sensitivity is also a key feature to look for when choosing a thermal imaging camera because it can affect the accuracy of the temperature measurements. The industry standard for temperature accuracy is $\pm 2^{\circ}\text{C}$.

Thermal imaging has become an accessible technology that is enabling data centres to replace traditional maintenance programs with predictive maintenance strategies. In addition, with the green agenda high on data centres' agendas, this technology can help comply with energy efficiency obligations. **EB**

Article contributed by Ideal Industries Inc. (www.idealindustries.ca).



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How to meet today's challenges in

testing enterprise fiber

Eric Corej



Today's demand for greater bandwidth in the enterprise is driven by factors including virtualization, the rise of the cloud, access to storage via Ethernet, server-to-server traffic, and massive volumes of data that need to be

accessed. As fiber becomes the core of every data centre network, the need to certify and test it becomes equally critical.

When fiber represented a minority of an enterprise's network links, either in the Storage Area Network (SAN) or the wide area link to the Internet, the job of fiber test and management was typically outsourced to specialists. However, today when organizations rely heavily on fiber to function, the health of an enterprise's fiber plant rises to the highest level of importance.

Maintaining tomorrow's fiber network with yesterday's troubleshooting tools is a recipe for frustration, if not disaster. To ensure that fiber in data centres is reliable, a network professional needs a more accurate and faster method for assessing the integrity of the infrastructure. Such a shift renders most existing testing equipment obsolete and instead demands a new class of optical time domain reflectometer (OTDR) that is capable of characterizing and certifying enterprise fiber quickly, accurately and without the "tribal knowledge" of a rarified fiber expert.

But, what are the parameters an installer or an enterprise site should consider when selecting an OTDR? Choosing the right device not only solves the new generation of testing requirements related to new technologies, but also helps professionals work efficiently while increasing the reliability and value of the enterprise fiber network.

To understand what you need to know, let's look back at the changes data centres are undergoing, and the implications these changes have on fiber testing requirements. Once you understand those challenges, criteria can be outlined for selecting an OTDR to satisfy evolving requirements.

What is driving change in fiber technology?

Modular cabling systems

With its plug-and-play capability, modular or pre-terminated fiber cabling is gaining acceptance because it is simpler and less costly to install than field-terminated cable. The challenge is that

pre-terminated fiber is only guaranteed "good" as it exists in the manufacturer's factory. It must then be transported, stored, and later bent and pulled during installation in the data centre. All kinds of performance uncertainties are introduced before fiber cables are deployed. Proper testing of pre-terminated cables after installation is the only way to guarantee performance in a live application.

High-density and high-speed equipment in the data centre

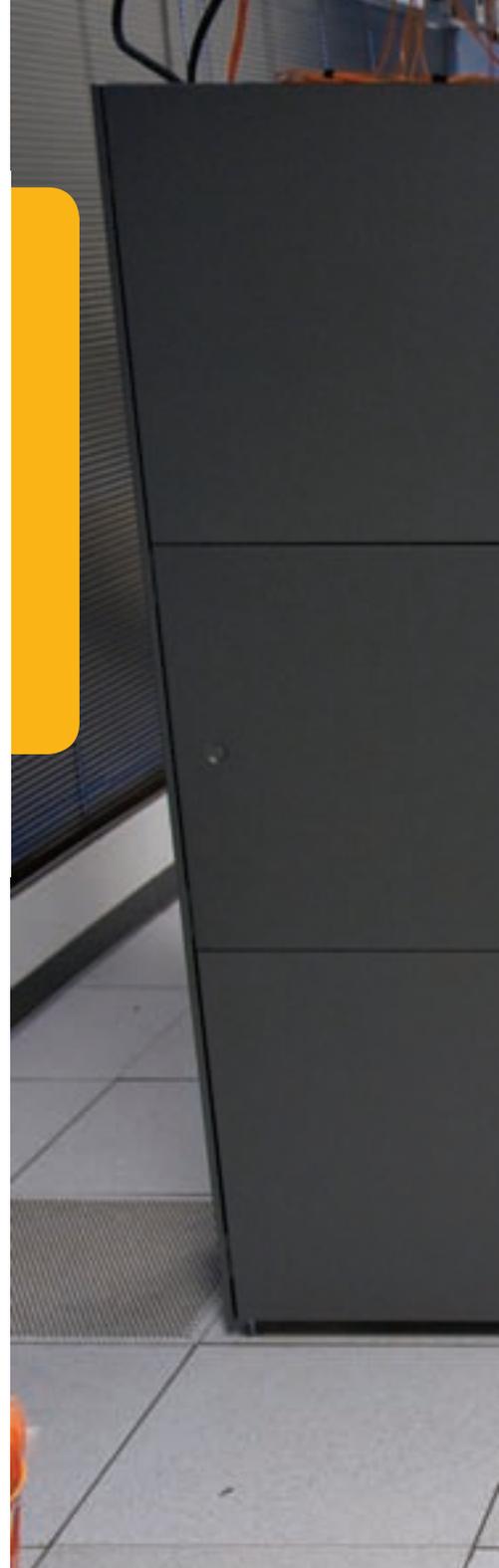
As data centres grow larger, most enterprise IT departments look for ways to minimize power consumption and reduce expensive floor space. One strategy for reigning in operational expenses is data centre consolidation using faster and higher-density networking and storage equipment. These new-generation devices are usually equipped with 10Gbps or faster fiber links to transport traffic. This shift is driving a significant uptick in the use of fiber in data centres.

Data centre owners responsible for keeping critical enterprise IT services available must now ensure that the fiber infrastructure is hardened. With thousands of fibers being installed, they must be able to:

1. Fully certify and document that all fibers are installed correctly and for maximum efficiency.
2. Minimize fiber network downtime with the fastest possible problem resolution time.

Virtualization presents challenges along with advantages

The adoption of server and network virtualization dramatically affects data centre networks. The implication is two-fold. First, virtualization consolidates multiple server resources onto fewer physical platforms. This creates much greater data traffic to and from virtualized platforms. Second, this traffic may pass to direct-attached storage or through a switch to network-attached storage, other servers, or to the greater enterprise network. Data centres





The integrity of the data centre infrastructure is inextricably linked to the strength of the fiber network.

new cabling requirements. Intra-rack fibers in ToR configurations are typically less than 6 meters. To reduce clutter and improve equipment access, patch panels with short patch cords are usually employed to connect server, storage, and networking assets. This creates new problems:

1. A high concentration of fibers connecting the equipment to the patch panels can confuse installers regarding fiber polarity.
2. Short patch cords quality and workmanship defects are invisible to most fiber test equipment.

As virtualization marches forward, data centre networks will fundamentally change. To deliver bandwidth to virtualized assets, 10Gbps, 40Gbps or 100Gbps links will be employed throughout the data centre. Any uncertainty in the fiber links will jeopardize the stability and reliability of the network connected to those virtual servers. It is critical to have these fibers certified with channelized information and properly documented.

Key parameters for OTDR selection

So, what are the key parameters an installer at an enterprise site should consider when selecting a new OTDR?

With the technological evolution that is occurring in data centres, test requirements dramatically changed for the fiber networks that connect mission-critical servers, networking and storage devices. Selecting the proper OTDR to test your network not only strengthens its reliability, but also improves how quickly and efficiently the job is done, as well as documenting the quality of work. Here are some recommended criteria to consider, aside from the basic OTDR testing capabilities:

adapted to the requirements of virtualization by using End-of-Row (EoR) and Top-of-Rack (ToR) network topologies.

- **EoR:** topology places a switch at the logical end of a row of racks, replacing a single tier of home-run connections with two tiers of switches. Adding a second tier makes the network more adaptable. EoR shortens the length of the cables in the lower tier to the length of a row of racks. Shorter cables are generally easier to install and easier to change. EoR topology confines the impact of asset reconfiguration to a row of racks, rather than across an entire data centre. EoR

may reuse some elements of the existing physical network, however major upgrades are common.

- **ToR:** topology dedicates an Ethernet switch to every rack. The ToR switch interconnects server, storage and networking assets in each rack and provides a trunk connection to an aggregation point in the data centre. ToR also divides the physical connections into two tiers, but provides greater modularity inside a rack than the EoR topology.

Both EoR and ToR topologies support the bandwidth demands of virtualization and drive

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1. A simplified and task-focused user interface: Populating a data centre with thousands of tested fibers is an enormously time-consuming job. Maintaining fiber health is just as challenging and makes fast troubleshooting critical. Almost every OTDR on the market today is designed to cover carrier applications. As a result, many have very complicated user interfaces, which require the user to grapple with numerous buttons and controls and navigate cumbersome multi-level menus. While this is suitable for the fiber enthusiasts who test Telco fiber on a daily basis, it's a different story for enterprise network technicians. An OTDR designed around the enterprise workflow, with an intuitive user interface, greatly improves operating efficiency. Simple-to-use test equipment shortens the learning curve, reduces testing time, and ultimately saves money.
2. Precision fiber channel information: With the increasing use of short patch fibers and multi-fiber connectors, details on every link—loss, connector, and reflectance—are critical to ensuring performance. OTDRs with an attenuation dead zone of more than 3 m are no longer applicable for testing data centre fiber. Ultra-short dead zones are needed to find issues that jeopardize the link loss budget or cause serious signal degradation. In addition, fast problem resolution requires that faults and events be presented in a simple, graphical map so users at various skill levels can efficiently perform fiber troubleshooting and accelerate network recovery.
3. Effective planning and documentation: As data centres grow and change, coordinating projects and ensuring that all fibers are installed with certified quality is challenging. There are a number of software applications available for project management, but until recently none have been integrated with an OTDR. Integrated project management capabilities with cable-by-cable granularity can save time and planning effort. Look for an OTDR with built-in project management capability that allows you to plan day-to-day activities without using a PC or laptop. You should be able to use a single tool to control, monitor, consolidate and document all test results.

Data centre technology is advancing at a tremendous pace to meet the challenges of reliably delivering critical applications for enterprises. The integrity of the data centre infrastructure is inextricably linked to the strength of the fiber network. Yesterday's approach and tactics have provided valuable lessons. Today's requirements are dramatically different from the past, presenting new challenges that require new solutions. It is important to evaluate these new parameters when selecting tools to ensure work efficiency and performance. **EB**

Eric Corej is national sales manager for Fluke Networks Canada, a provider of network test & monitoring solutions to speed the deployment and improve the performance of networks and applications. He can be reached at eric.corej@flukenetworks.com.

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LED LIGHTING brings new radiance, energy savings to Marriott HQ

LED solutions were recently installed in several locations at Marriott International's headquarters located in Bethesda, Md. The installations aimed to enrich lighting quality, heighten employee security and improve energy efficiency. Following its corporate campus-wide lighting update, Marriott will use 860,000-fewer kilowatt-hours (kWh) of electricity, and save more than \$120,000 in combined energy and maintenance costs annually.

Enhancing outdoor security while saving money

Security and energy savings were top priorities when considering new lighting to cover the nearly 2 million square feet (45 acres) of parking and garage space at Marriott HQ. After testing competitive exterior garage fixtures, parking lot lights and contemporary post tops, Marriott selected GE LED lighting systems.

The company performed a comprehensive lighting audit of our existing system, explains Jim Young, VP corporate facilities for Marriott International Inc., "provided photometric analysis with 3D renderings of the new system, and forecast our energy and maintenance savings".

More than 230 LED area lights now illuminate Marriott's outdoor lots, while inside the parking deck nearly 400 LED garage light fixtures and several LED tunnel light installations—as well as more-efficient T8 fluorescent lamps—help light the way for associates to and from the headquarters

offices. Collectively, a 280W reduction per outdoor lighting fixture will cut electricity use by 580,000 kWh annually, equating to \$70,000 in utility cost savings.

Marriott also gained the functionality to dim its new garage lighting with a lighting control system incorporating motion sensors. Light output is reduced to 40% while the garage is vacant and adjusts to 100% when motion is detected. Alone, this precise control will produce nearly \$11,000 in energy savings (88,000-kWh reduction) each year. And the control system will interface with Marriott's video surveillance centre, alerting guards to after-hours movement in the deck and focusing the nearest security camera to where motion is detected.

Marriott also coordinated with Montgomery County government officials to replace 32 180W metal halide streetlights along the road that serves its headquarters and neighbouring companies. With the first cost of 106W LED roadway cobrahead fixtures covered by Marriott, the county will see an immediate benefit: using 10,000 fewer kWh each year provides a \$1200 annual energy savings.

Investing in indoor illumination

Moving inside Marriott's eight-floor, 900,000-sf headquarters, one thousand 65W bulbs were replaced with 7W LED PAR20 lamps in all hallways. The 58W difference will mean a nearly \$18,000 difference (150,000-kWh savings) in electricity expense over 261 working days.

GE retrofit the 'Marriott' sign at the Bethesda headquarters entrance with Tetra PowerStrip LED lighting, improving maintenance cycles from two to three times per year to once every five to 10 years.



GE replaced 1000 65W bulbs with 7W LED PAR20 lamps in all hallways.



In the foyer, special scaffolding is needed to reach fixtures in the high ceiling. Marriott would change the lights—which lasted just one to two years on average—only once a year at a cost close to \$3000. Maintenance savings will now add up after GE replaced 12 90W bulbs with 20W LED PAR38 lamps, which are rated for 50,000 hours.



More than 230 Evolve LED area lights now illuminate Marriott's outdoor lots.



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In the auditorium, meantime, combined halogen and compact fluorescent lamp (CFL) lighting was inadequate for Marriott's advanced dimming system; while the halogen lights could be darkened, the CFLs could not. A total of 140 12W LED BR30 lamps improved the functionality of the space, producing a fully dimmable system with higher light levels and more light uniformity—in addition to \$2300 in energy savings.

72 new LED troffers were added to the building's lower level. When illuminated, the 2 x 2-ft fixtures produce an even glow. While off, they appear completely free of a light source to blend in with the ceiling, enhancing the aesthetic of Marriott's employee space that includes a daycare and cafeteria.

Also retrofitted with LED lighting was the 'Marriott' sign at the Bethesda HQ entrance, improving maintenance cycles from two to three times per year to once every five to 10 years.

Rapid returns

Marriott's comprehensive LED update will decrease annual electricity use by 66% (680,000 kWh outside; 180,000 kWh inside) at its headquarters, slashing energy expense an estimated \$104,000. Maintenance mitigation will yield an additional \$210,000 savings over the next decade for a total return exceeding \$120,000 annually. Marriott will also receive more than \$130,000 in utility rebates and EPACT savings. All told, the anticipated payback period for the lighting project is slightly more than two years, based on combined electricity, maintenance and labour reductions. **E3**

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WHAT you should know before investing in commercial rooftop SOLAR

Amir Keranovic

If you are an investor or commercial building owner who is considering utility-scale rooftop solar, there are several questions you should be asking: What are my options? What is the best mounting method for installation? Does it affect the roof warranty? What are the short- and long-term risks? How do I minimize risk while increasing ROI?

Several years have passed since the Ontario Power Authority (OPA) launched North America's first renewable energy-promoting feed-in tariff (FIT) program, allowing enough time for several large-scale, commercial rooftop solar energy systems to be fully deployed.

Thanks to this first group of innovative, grid-tied projects (and the pioneers who made them possible), a proper comparison can now be performed, focusing on energy output, building impact, durability, safety, aesthetics and other once-unknown factors.

Ballasted versus structurally attached

There are several ways to integrate a solar array on a flat commercial rooftop. The two most common solutions offered are ballasted and raised (also known as structurally attached), and each presents its own set of challenges.

A ballasted system, which is most common, uses solar panels that are not tied into the infrastructure of the building; the panels are fastened to metal or plastic racking systems

designed to rest directly on top of the roof membrane. This system is the least expensive and quickest to install, but has several drawbacks, including the probability of long-term roof damage. Extreme temperature changes are known to cause roof membranes to expand and contract while causing them to become brittle. When combined with the excess weight of a ballasted system, it's probable that the roof may experience cracking, leading to leakage.

Additionally, this added long-term weight can cause sloping or an unevenness on the roof membrane, promoting long-term issues with drainage. This is referred to as pooling, affecting the roof's ability to shed water, snow or debris.

On the other hand, a structurally attached solar solution can be installed as low as 3 inches to as high as 12 feet above the roof surface, depending on aesthetic preference, without having a detrimental impact on the roof membrane in any way. In fact, raised solar solutions are proving to add protection from the elements—the sun included—while prolonging the life of the roof membrane.

Some of the same basic engineering required to add a second story to an existing building is implemented into the design of a

raised solar solution. Steel beams and girders are tied directly into the building's structure, supporting the weight of the solar racking, panels, inverters, cabling and any

other additional loading caused by weather.

Ballasted panels should be mounted at a lower angle, typically up to 20 degrees, to avoid any sail effect caused from moderate winds, decreasing the possibility of them being overturned or blowing away. However, this low angling makes it more difficult for snow to slide off of the modules, allowing for excessive precipitation build-up and blockage from the sun, adding undue risk to the building through added weight while reducing energy output.

To maximize returns through the amount of energy captured by the sun's rays while encouraging snow to slide off, a solar module should be positioned higher at 33 degrees. As a result, installers in the Ontario are pressured to raise the angle to the heights of their systems, despite wind sail risk.

This decision is proving to be detrimental, as some multi-million-dollar ballasted solar power stations are being thrown into disarray by winds. Reportedly, systems are being flipped into a perilous state after only one year of use. Upsetting electrical power generating stations in this way (while live) may put the host building, along with its main core business, at exponential risk.

Concern that this risk could extend onto

pedestrians on street level is also raised, reinforcing the notion that going cheap isn't necessarily the cheapest way to go.

Puncturing the membrane ain't so bad

Although structurally attached solar solutions are more expensive to initially install, the possibility of them moving once installed is completely eliminated and optimal panel angling is permitted, allowing for the capture of increased sunlight and revenues. Structurally attached systems do, however, require penetrations to be made to the roof membrane because they are tied directly into the building's main supports.

Although this seems to be a concern for some landlords, the average commercial rooftop already has dozens of penetrations. Anywhere there is an existing drain, duct or vent, access hatch, HVAC system, etc., there is an existing penetration. Providing penetrations are properly flashed and sealed, moisture should not be an issue, and can be warranted separate from the rooftop. To further reduce risk, a moisture detection system can be implemented beneath the flashing of each penetration, electronically monitoring the isolated area, identifying traces of moisture before it has the opportunity to become an issue.

Although a ballasted solution does not require any penetrations (a leveraged selling point), thorough inspections should be performed upon completion, observing for any sharp corners or screws that may protrude from the racking. In the event the racking is to flip and/or be dragged due to sailing, these protrusions can puncture roof membranes.

Roof warranties, inspection and repair

Depending on its age, a commercial roof may be warranted from the company who originally installed it. Roof warranties, no matter how thorough, will generally not cover damages caused from ballasted solar arrays, unless an additional roof warranty is purchased. Often a commercial rooftop warranty will be completely void the moment a ballasted system is installed. Building owners need to check their roof warranty contracts before signing on the

dotted line. (The average warranty or expected life of a commercial rooftop varies from five to 20 years, depending on the quality.)

Most roofing companies will not provide extended warranties for single-ply rooftops. Single-ply is commonly used on large commercial new-builds, including many of the big box-type stores. Most buildings with single-ply roofs are deemed structurally unsound for solar by structural engineers, due to their inability to support the weight. However these engineering challenges may

easily be overcome with a raised and/or connected solution because they rely on the walls and columns of the structure for support.

Up to 35% of some rooftop solar energy developer's portfolios have been eradicated due to not meeting engineering requirements. The raised solution allows for most of those projects to be resurrected.

The ballasted system is also less accommodating when it comes to profile obstructions or variables in the buildings height. Additional floors or levels on one side of a host building and/or excessive HVAC



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systems or air vents, may exclude the structure from being a candidate for solar due to shading. Often a connected solution can overcome all of these variables, while simply being raised above the obstructions, allowing for the maximum amount of modules to be evenly implemented. Often as much as 150% more panels can be incorporated into a raised system, maximizing energy output and profits.

Because the ballasted system sits directly on the roof, it is also vulnerable to significant energy loss due to excessive heat rising from the roof during warmer months. The hotter solar panels get, the less electricity they produce. A structurally attached solution overcomes this issue, because the panels are not enclosed in a plastic box while allowing ample air to flow between the hot roof and the back of the panels, reducing heat build-up while enabling operation at optimal temperatures.

A typical ballasted system may use rubber boots or even cinder blocks to weigh down the racking on top of the roof membrane, or they may be constructed of plastic bins filled with gravel or sand for anchoring. Although more affordable and easier to install, the bin design deserves additional concern involving overheating and drainage. Precipitation has the tendency to not mix well with the gravel or sand, especially after freezing, not only creating a mess, but potentially blocking air-flow while impeding drainage. This should create concern towards overheating and short circuiting.

Locating a leak in a rooftop that hosts a ballasted system may be next to impossible and moving partial or an entire operating system for any reason can upset wiring (as

indicated), again potentially leading to short circuiting.

In the event the landlord wants to repair, replace or re-tar the roof, the system has to be removed, creating a very costly additional expense. Some solar companies claim to offer removal of the system once during the lifetime of the project (at no charge) but “offering” versus actually doing are two completely different topics. In addition, removing the array for any extended period will require system downtime, resulting in lost revenues. (A typical 250kW ballasted solar array can cost up to \$500k to remove and reinstall, and can cost up to three weeks of system downtime).

All about doing your homework

These exposures should be considered when evaluating a ballasted system’s financial model while comparing solar PV solutions... unless the stakeholder plans on relinquishing interest in the project soon after it is built. On the same note, investors who may be considering adding portfolios containing these types of projects to their funds must consider these variables before investing.

Not surprisingly, most of the structurally raised systems already installed in Ontario are owned by the building owners themselves, meaning they had agreed to the extra initial capital costs as opposed to assuming the long-term risks associated with the ballasted systems.

Comparatively, most of the ballasted systems in Ontario are owned by third parties, not the building’s owner. These third parties generally do not occupy the buildings, but rather rent the rooftop space through long-term lease agreements.

It’s clear that while structurally attached arrays are initially more expensive at the point of construction, additional costs are offset through a significant reduction in short- and long-term risk, combined with increased revenues enabled by their ability to produce more electricity. However the additional cost of a raised solution may not always be validated. In the event that a building has a concrete roof, or when the building is unoccupied, or excessive weight is proven not to be an issue, a connected system may not make economic sense.

Despite making sense on paper, field trials are necessary to help establish the new technologies that work best. **EB**

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GE

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Acuity Brands unveils Visual Economic Tool for lighting systems



Acuity Brands says it has developed a leap-forward financial tool that allows users to determine the true economic value of a lighting system, greatly exceeding the simple data output found on many industry "payback" calculators. Using the Visual Economic Tool, users can input data from any lighting product (including non-Acuity Brands lighting products) to estimate and compare the life-cycle costs of up to three lighting systems. Users can conduct energy-only estimates or create estimates that include maintenance, lighting controls and HVAC data, creating an estimated economic return, life-cycle cost, net present value and internal rate of return.

ACUITY BRANDS

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Norwell Lighting & Accessories launches new 2012 catalogue

Norwell Manufacturing has published a new residential lighting and accessories catalogue, featuring a variety of kitchen, bath, wall sconces, pendants and outdoor lighting and accessory solutions. The Norwell Lighting & Accessories catalogue has been

organized so users can locate the product and complimentary accessories by application.

NORWELL LIGHTING & ACCESSORIES

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LumenOptix LRD - LED Retrofit Downlight luminaire

LumenOptix's new LRD, LED Retrofit Downlight luminaire, claims to upgrade a

downlight of any make, model and size in minutes to energy-efficient, maintenance-free LED technology. According to LumenOptix, the LRD delivers up to 70% energy savings and secures to the existing, installed rough-in kit through its modular bracket system. The LRD is dimmable down to 10% through 0-10V or line dimming.

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Ideal Industries has announced an upgraded version of its HeatSeeker handheld thermal imaging camera now with twice the resolution of legacy models and a wider field-of-view to improve troubleshooting efficiency. Engineered with a 320 x 240 2MP sensor that captures 76K pixels, the new HeatSeeker 320 is suitable for applications such as energy audits, data centre evaluation, industrial maintenance and electrical safety. Other key features include picture-in-picture imaging, text and voice annotation of images and sequence image recording by time or alarm settings.

IDEAL INDUSTRIES
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Nuheat unveils redesigned free-form floor heating cable

Floor heating system player Nuheat unveiled its completely redesigned, free-form floor heating solution: Nuheat Cable. The system covers up to 240 sf using a single kit; representing an increase of 33% over Nuheat's old cable, this system now covers large spaces such as



basements, hallways and living rooms. Based on customer feedback, the design offers a floor heating solution for tile, stone and laminate/engineered wood floors. Other notable improvements include patent-pending cable guide design and thinner factory splice. The zero EMF (electromagnetic field) cable design includes a 25-year warranty.

NUHEAT
www.nuheat.com

Little Giant debuts Combo SXE and Lunar ladders

Little Giant Ladder Systems has developed the Combo SXE combination and Lunar extension ladders. The Combo SXE functions as both a 13'-extension ladder and a multi-height stepladder that works on uneven surfaces, and features a Triple-Lock Hinge for adjustment from storage to stepladder to extension. The Lunar includes Little Giant's side-mounted double pulley system to help reduce the force needed to extend the fly section, and claims to be 25% lighter than other



ladders on the market. According to the company, both ladder designs feature increased versatility features to help minimize injuries.

LITTLE GIANT LADDER SYSTEMS
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Carhartt Flame Resistant jean available through Cintas

Cintas Corp., a North American uniform supplier, has added the Carhartt Flame Resistant (FR) jean to its exclusive line of Carhartt Rental Workwear. The Carhartt FR jean is a Hazard Risk Category 2 garment made with 14.75-ounce, 100% flame resistant cotton denim, and features



a relaxed fit and leg openings to fit over work boots. Cintas also provides personal protective equipment (PPE) such as face shields and balaclavas, voltage tools, task wear and more.

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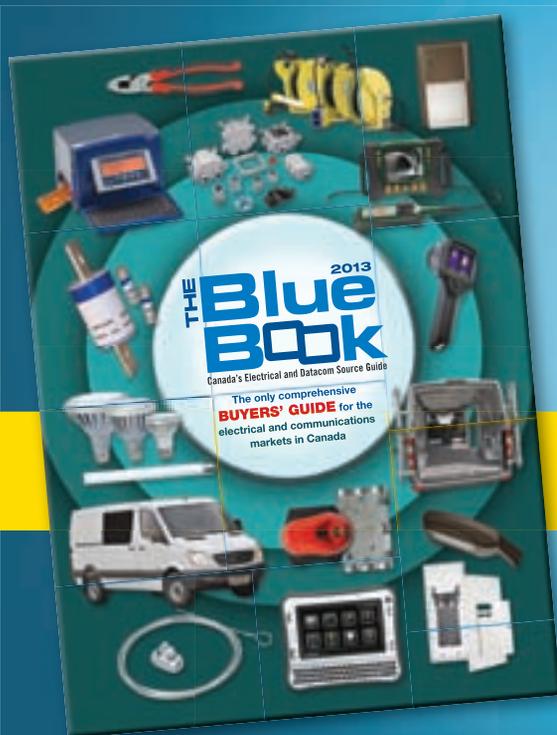
Brady releases new Visual Workplace Handbook



Brady has published a new Visual Workplace handbook, a free 21-page guide that outlines its best practices for lean visual management. The free handbook explains the lean manufacturing concept of a visual workplace (also known as visual factory), and provides real-world examples of how visuals can be used to create a safer, more efficient workplace. The handbook also explains how to identify information deficits and provides several ways to incorporate visuals into an organization's existing lean activities.

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ADVERTISER INDEX

ADVERTISER.....PAGE	ADVERTISER.....PAGE
ABB Inc.....31	L. Stoch & Associates37
Acklands-Grainger.....29	Leviton28
Allpriser10	Maintrain35
Arlington Industries19	Mercedes-Benz Canada25
Bluebook36	Mersen9
Canadian Standards Association...38	Nexans1
CodeSafety Associates37	Nissan Canada13
Falvo Electrical Supply.....37	Northern Cables.....7
FLIR Canada21	Ontario Power Authority33
Fluke12	Schneider Electric11
Hammond Power Solutions.....8	Southwire Canada39
Hubbell Wiring24	Standard Products.....2
IED Ltd.40	Stanpro Lighting Systems16,17
IPEX.....15	Thomas & Betts.....1,5
JMC Steel Group.....34	United Wire4
	Venture Lighting.....23



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Inductive heating in metallic enclosures

The term ‘eddy currents’ is used only once in the Canadian Electrical Code, 22nd Edition, 2012. There is a short note in Appendix B explaining the heating effect in ferrous materials when energized single-conductor cables pass through the ferrous material.

While most electricians are familiar with this term, many do not recognize the potentially destructive impact on electrical installations that exist when these currents are ignored. In fact, electrical equipment failures have occurred due to inductive heating.

Eddy currents are generated in conductive materials such as metallic equipment enclosures when single-conductor cables pass through them. When alternating current flows through a conductor, a magnetic field is generated around the conductor. As the alternating current sine wave reverses direction two times every cycle, the magnetic field that surrounds the conductor also reverses its direction two times per cycle. This increasing and decreasing magnetic field induces eddy currents in the ferrous metal enclosures surrounding the conductors.

The additional effect is that the metallic enclosure wall itself has magnetic properties, and a magnetic field will be set up within

the wall. The energy consumed in setting up this field causes heating in the wall known as *hysteresis heating*. These two electromagnetic properties—hysteresis and eddy currents—combine to generate heat in metal enclosures when energized single-conductor cables pass through them. Relatively low currents can generate a considerable amount of heat to melt the single-conductor cable insulation leading to line-to-ground faults.

The revised CEC Rule 4-010 “Induced voltages and currents in metal armour or sheaths of single-conductor cables”, Subrules (3), (4) and (6) require that: single-conductor cables carrying more than 200A must not enter ferrous metal boxes through individual openings; precautions must be taken to prevent overheating of the wall of the box by induction; and all cables making up a circuit must enter the box through one common non-ferrous or insulating plate having a minimum thickness of 6 mm. In addition, Subrule 5 states that precautions to be taken to prevent overheating of the metal must include the use of non-ferrous or non-metallic box connectors or cable glands, locknuts, bushings and ground bushings.

It should be noted that below 200A these special preventive measures are not required.

Also, although the CEC 4-010 Rule speaks to single conductors with metal armour or metallic sheath, the concern regarding induced heating will also apply to any unarmoured cables. This requirement is covered under CEC Rule 12-3022 “Entrance of conductors into boxes, cabinets and fittings”, Subrule 7. It states where single-conductor cables or conductors enter metal boxes through separate openings, precautions must be taken as specified in Rule 4-010.

The metal surrounding the energized conductors or cables may not always be obvious. It can be the reinforcing steel in concrete slabs or a metal bracket used to support the conductors or steel roof support bracket. To avoid inductive heating, conductors should be run together, using non-ferromagnetic materials such as aluminum, and should use aluminum or fiberboard where the conductors enter the enclosures. **EB**

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

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

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

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

Question 1

Unless the ground fault circuit interrupter is an integral part of an approved factory built spa, or located behind a barrier, it shall be installed not closer than:

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

Question 2

For wind turbines forming a small wind system connected to single dwellings, turbine output circuits shall be permitted to have a maximum nominal voltage up to:

- a) 120V c) 240V
- b) 208V d) 600V

Question 3

Electrical non-metallic tubing shall not be used where normal conditions are such that any part of the tubing is subject to temperature in excess of 60°C.

- a) True b) False

Answers: EBMag August 2012

Q-1: Receptacles required for maintenance of rooftop HVAC equipment shall be protected by a ground fault circuit interrupter of Class A type.

a) True. Ref. Rule 26-704.

Q-2: Only inverters approved and identified as interactive are permitted in interactive systems.

a) True. Ref. Rule 64-108

Q-3: Receptacles located between ___ and ___ of the inside walls of a pool shall be protected by a ground fault circuit interrupter of Class A type.

d) 1.5m, 3.0m. Ref. Rule 68-064.

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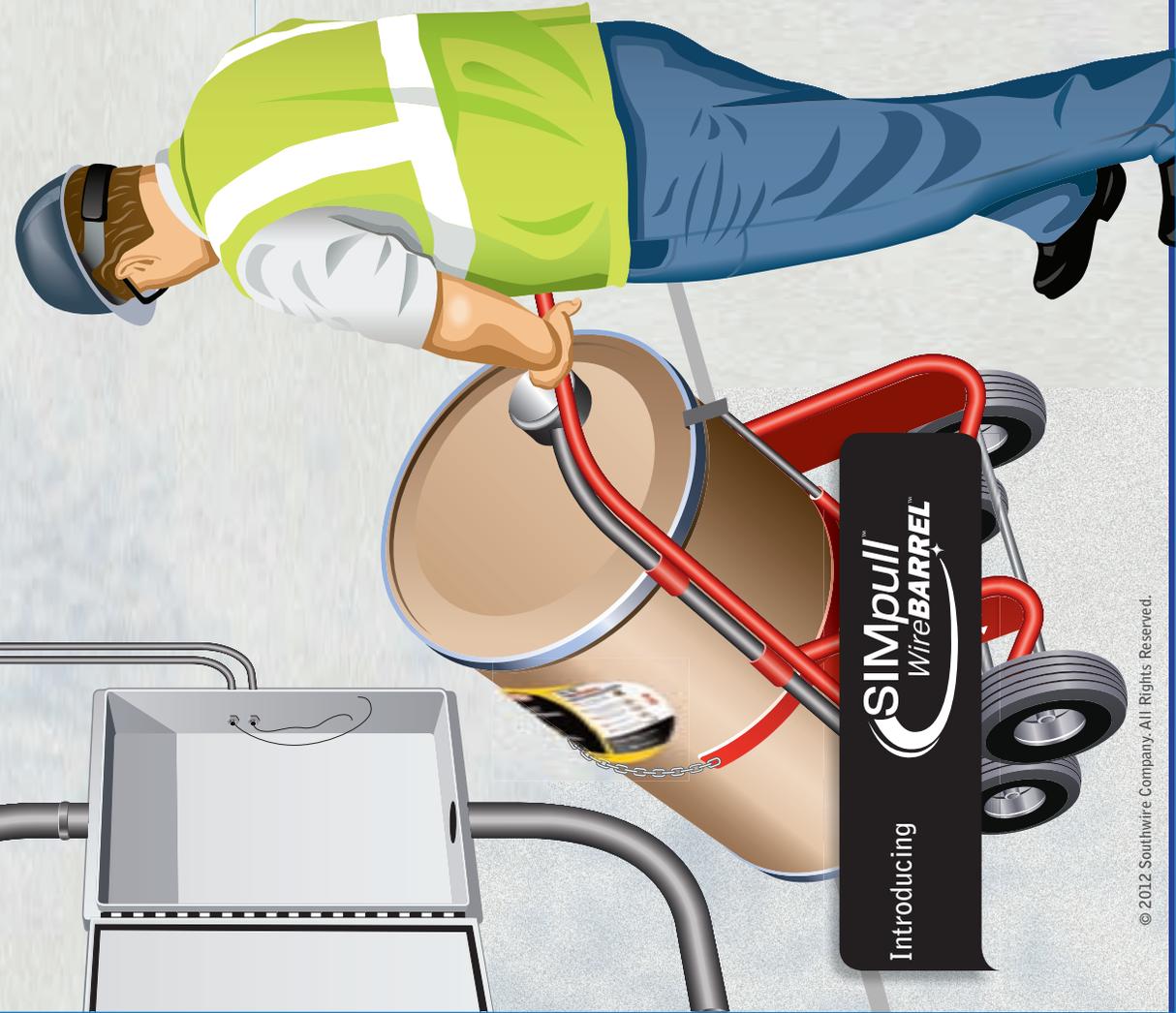
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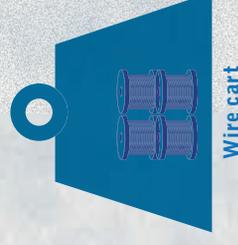
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