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Electrical Business

FEBRUARY 2012

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Update your address book! The EBMag team has moved to its new office.

Update your address book... we've moved!

By the time you read this, the Electrical Business team will be in its new office, so please take a moment to jot down our new physical address:

222 Edward Street
Aurora ON L4G 1W6

Meantime, our mailing address is now:

P.O. Box 775
Aurora ON L4G 4J9

Our phone numbers and emails remain the same.

With that out of the way, I want to take a moment to highlight two events I'm really excited to be attending this Spring that you should also consider:

IEEE IAS Electrical Safety, Technical & Mega Projects Workshop
March 19-21, Edmonton, Alta.
www.ieee.org/estmp

I attended my first Mega Projects workshop in 2010, and it truly lived up to its claim of providing a forum for exchanging and advancing industry knowledge in the areas of electrical safety, engineering design and system reliability, and the implementation and execution of mega projects.

We're not talking some ordinary strip mall here, but rather projects in the petroleum or petrochemical industries, for example, that can easily be worth over half-a-billion dollars!

The workshop is not a training course. Instead, it focuses on sharing innovative concepts and successes, as well as lessons learned in the areas of advancing the application of state-of-the-art knowledge and best practices; stimulating innovation in creating the next generation of technology; and the design and implementation of mega projects.

BICSI Canadian Conference & Exhibition
April 29-May 2, Niagara Falls, Ont.
www.bicsi.org/canadian/2012

BICSI is a professional association supporting the information technology systems (ITS) industry, which includes voice, data, electronic safety & security, and audio & video technologies. This encompasses the design, integration and installation of pathways, spaces, fiber- and copper-based distribution systems, wireless-based systems and infrastructure.

And we continue to strongly believe this market holds great opportunity for you. Over the years, some of you have told me that, while you might do the rough-in for datacom, you hand over that work to someone else. And I always ask, Why should someone else get that cash when *you're already there?*

Thankfully, others of you have come to this same conclusion, and have built up a datacom expertise. For either group, though, it is important to stay on top (if not ahead) of the game.

Events like the BICSI Canadian Conference and IEEE IAS Electrical Safety, Technical & Mega Projects Workshop provide the networking you need with subject matter experts, vendors and folks like yourself to help you succeed. EB

On the cover and page 20

Overhead cabling saves energy in data centres

While common practice, building raised floors in data centres is not necessarily the most energy-efficient approach to cooling, as power and data cables placed in overhead cable trays can result in an energy savings of 24%.

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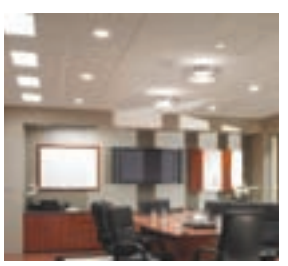

DEPARTMENTS

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Registration open NOW for "Apprenticeship-Strategies for Success"

Registration is now open for the Canadian Apprenticeship Forum's (CAF-FCA, www.caf-fca.org) 2012 conference "Apprenticeship-Strategies for Success", being held in Regina, Sask., June 3-5. As the conference traditionally sells out, CAF encourages you to sign up as soon as possible.

CAF has also published the conference's full agenda, which includes sessions such as:

- A plenary presentation entitled "Apprenticeship Strategies for Success: Diversity, Innovation, Engagement" with guest panelists from Ontario College of Trades; British Columbia Institute of Technology; and Saskatchewan Indian Institute of Technologies.
- "Supporting Apprenticeship Success through the MOST Program" presented by Suncor Energy Inc.

Early Bird pricing is available until March 31. Visit www.caf-fca.org/conference to register.

Electrical Business

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Canada

CCAB BPA WORLDWIDE BUSINESS

ESA Warning - Ningbo Yunhuan YY-2ZA power bars

The Electrical Safety Authority (ESA, www.esasafe.com) is notifying consumers about unapproved outlet power bars, model YY-2ZA, that are manufactured by Ningbo Yunhuan Electronics Group Corp. These products are unapproved, not tested to any Canadian Safety Standards, and do not bear any recognized certification mark for Canada.

ESA is advising consumers to stop using these products immediately.

Join the BC Hydro panel and you could win $300!

BC Hydro (www.bchydro.com) is looking for customers to share their opinions and influence the future of BC Hydro. As a panellist, you'll get an insider's view of some of BC Hydro's upcoming projects, participate in online surveys and discussions, help make business decisions and enter in draws for ongoing prizes.

Your Power Poll (www.yourpowerpoll.ca) is a new, exclusive online community of customers actively engaging with BC Hydro on different issues. When you sign up, you'll be entered into a draw for one of three $300 gift certificates.

"We welcome your insights about important topics like smart meters, rates and energy conservation," explained BC Hydro. "This is the place to share your thoughts."

Anyone over the age of 18 living in B.C. is eligible to join Your Power Poll. To join, visit yourpowerpoll.ca and complete a short survey. As a registered panellist, you'll have a chance to win one of three $300 gift certificates to London Drugs, Best Buy, Amazon.ca, Chapters, Home Depot or Future Shop.

Silfab Ontario to supply Sunny Day Energy with 5 MWp domestic content modules

Silfab Ontario (www.silfab.ca) and Sunny Day Energy have entered into an agreement to supply approximately 5 MWp of domestic content modules, for the latter will install at different commercial rooftop projects in the Greater Toronto Area, ranging in size between 200 and 500 KWp.

The SLA 60 cells single-crystalline modules, with a power pick of 255 and 260 Wp, are manufactured at Silfab Ontario's new production plant in Mississauga, Ont., and satisfy the local Feed-In-Tariff (FIT) program's domestic content requirement. The plant opened earlier this year.

"A project like this," said Franco Traverso, president of Silfab Ontario, "keeps production lines running and people employed, and gives us strong visibility in the upcoming years. Ontario is still a photovoltaic market with a huge potential, despite the current discussions about the decrease of FITs and the resulting temporary cooling of the demand."

According to the company, Sunny Day opted for Silfab Ontario partly because of its "commitment to quality, highly efficient and maintained production facility" and ability to offer modules using either poly-crystalline or mono-crystalline silicon in both 60 and 72 cell counts.

The majority of the rooftop projects will be developed by RESCo Energy Inc., a full service Engineering, Procurement, Construction and Maintenance (EPCM) firm focusing on rooftop solar PV energy systems.

Public and private sectors are pushing electric vehicles, but are consumers interested?
Various polls show Canadian drivers' attitude toward electric vehicles is changing in a favourable way. EV-related vendors, auto manufacturers and all levels of government are making a collective effort to demonstrate the benefits of EVs to consumers: reduced emissions; convenience of home charging; cushioning from fuel price volatility; and long-term cost savings. However, the extent to which attitude change can be translated to actual sales is a different question.

Paul Scott, a founding board member of Plug-In America, responds to consumer worries regarding the lack of public charging stations: "Adequate infrastructure does exist for most people. Anyone with a single-family home has a power source that can easily be used for nearly 100% of their driving". Undoubtedly, one of the hardest aspects of consumer education is convincing drivers they don't actually drive as much as they think.

These kinds of issues are being discussed all over the world by private sector senior executives and government leaders. But on February 22-23, Toronto will host its own senior-level conference on electric vehicles and what must be done to encourage their rapid adoption: The Electric Vehicle & Infrastructure Summit (www.evehiclesummit.com). And Electrical Business (www.EBMag.com) is a proud media supporter.

"We are at a crucial time when market acceptance of this new technology will depend on the ability of leaders to work together across sectors in support of infrastructure developments," says Andrew Bowerbank, an authority on sustainable development and low-carbon economics. "Consumers need to have confidence that EVs are the next big wave. Summits like this provide the much-needed forums for leaders to meet, share ideas and discuss issues in support of market transformation."

The Electric Vehicle & Infrastructure Summit will be attended by provincial ministries, federal agencies, utilities, energy regulators and vendors showcasing innovative EV technologies. For the full agenda, speaker roster and venue specifics, visit www.evehiclesummit.com.

Hydro One launches scholarship for First Nations, Métis and Inuit students
Earlier this month saw the launch of the Hydro One FNMI Award, an academic scholarship for First Nations, Métis and Inuit (FNMI) students to support their post-secondary education in power-related studies.

"Our Hydro One FNMI Award provides students with monetary support and hands-on work experience that can help them learn, grow and achieve in power-related careers," said Laura Formusa, president and CEO, Hydro One (www.hydroone.com). "We are proud to support the FNMI community and to be recognized for playing an important role in increasing the representation of First Nations, Métis and Inuit people in our industry."

The Hydro One FNMI Award is granted annually to two FNMI students (where possible, one male and one female) studying power-related disciplines at a recognized Ontario university or community college. The recipients of the award are also offered a developmental work term at Hydro One.

Interested? Visit Hydro One's website (www.HydroOne.com/Careers) to complete and submit an application form, or email aboriginal.recruitment@hydroone.com.

Mitsubishi now ready to take 2012 i-MiEV orders in Canada

Mitsubishi (www.mitsubishi-motors.ca/en) is suggesting Canadians looking for an "affordable electric vehicle" visit one of 30 select dealers to reserve the new 2012 i-MiEV (Mitsubishi Innovative Electric Vehicle).

"This is a day that marks a new era for Mitsubishi in Canada," said Shin Fujioka, president and CEO of Mitsubishi Motor Sales of Canada Inc. (MMSCAN). "The i-MiEV is the most efficient, most vibrant and most affordable electric vehicle available in the Canadian market and we are excited that we will soon see i-MiEVs on roads across the country."

Certified MiEV dealers go through a rigorous, detailed training and education program in order to be qualified to retail and service the i-MiEV, explained the automaker. Visit bit.ly/zPYfnN to locate the closest dealer in your area.

"The i-MiEV, while easy to drive, is a very advanced vehicle and our dealers have shown a great interest in being trained and approved to provide top of the line service to our customers," added Fujioka.

The vehicle is a five-door, 4-passenger, subcompact hatchback that has been designed and packaged to be efficient, ecological and fun to drive. The automaker claims it will be the most affordable, mass-produced, all-electric vehicle in the Canadian marketplace, and with a range of up to 155km, with a top speed of 130km/h, make an excellent commuter vehicle for Canadian urbanites.

Discontinued - Carmanah and Ruud Lighting exclusive marketing agreement

The exclusive marketing agreement between Carmanah Technologies Corp. (www.carmanah.com) and Ruud Lighting Inc. (www.cree.com, now a wholly owned subsidiary of Cree Inc.) discontinued as of the expiration of the current agreement on November 6, 2011. Established in May 2008, the agreement effectively paired Carmanah stand-alone solar power engines with Ruud's spec-grade BetaLED exterior LED luminaires. While Carmanah intends to work with Ruud on a non-exclusive basis in continuing to offer these luminaires, the company also recognizes that other luminaires will complement its proprietary solar power engines. Carmanah said it is "very pleased with the performance and reliability of the BetaLED luminaires" and will continue to supply EverGEN solar outdoor lighting systems with BetaLED luminaires as an option in the future.

"The expiration of the agreement between Carmanah and Ruud Lighting is an evolution of our relationship, and provides both companies the flexibility to explore other opportunities to continue to develop and supply innovative solar-powered outdoor lighting products as the adoption of this technology continues to grow," it added.

ABB to acquire Newave and broaden UPS offering

Ulrich Spiesshofer

ABB (www.abb.ca, a power and automation technology group) and Newave Energy Holding SA (www.newavenergy.com, a Quartino, Switzerland-based uninterruptible power supply player), have agreed that ABB will acquire Newave in an all-cash transaction. The deal, says ABB, will strengthen its position in the power control and quality market, and provide Newave with significant growth opportunities outside its traditional markets in Europe.

ABB plans to integrate Newave in its Discrete Automation & Motion division, and develop Quartino to become a main location for ABB's UPS systems.

"The combination of two strong, complementary companies will create significant value-driven growth based on innovation, high quality and technology leadership," said Ulrich Spiesshofer (in photo), head of ABB's Discrete Automation & Motion division. "The acquisition is fully in line with ABB's strategy for power control and quality and with the goal of the division to build on its existing strength in power electronics. Newave provides us a best-in-class player in the fast-growing UPS market, while our global sales channels will significantly expand Newave's geographic reach."

The global UPS market offers interesting growth opportunities, says ABB, mainly in the areas of data centres, industry and infrastructure. ABB will expand into a $6- to $7-billion market and "close a white spot in core data centre electrification and industrial power quality".

Newave is active in the medium- and high-power UPS range, which is the most attractive segment, insists ABB, since it represents 50% of the overall UPS market with a yearly growth rate of 6-10%. EB

David Collie, president and CEO of the **Electrical Safety Authority** (ESA, www.esasafe.com), has announced that **Doug Crawford** will join ESA as vice president and chief public safety officer. Crawford joins ESA from the Office of the Fire Marshal (OFM) of Ontario where he was deputy fire marshal. His experience in harm prevention strategy and management of OFM activities is an excellent fit with ESA and the role of the chief public safety officer, said ESA. "We have worked with Doug in his capacity as deputy fire marshal on a number of shared safety initiatives. He brings great knowledge, experience, and insight," said Collie. He holds a Masters in Engineering from the University of Toronto and is a registered professional engineer. Crawford succeeds Peter Marcucci, who retired from ESA in December 2011.

Affiliated Distributors (A-D, www.adhq.com) has promoted **David Oldfather** to president of A-D's Electrical Divisions. Oldfather's promotion to president is part of A-D's establishment for "fully empowered, fully resourced" strategic business units for each A-D Division; Electrical, PHCP, Drywall and Industrial, explained the company. In addition, A-D announced that **Pam Erickson**, VP of marketing, Electrical Divisions, will focus solely on electrical division marketing, reporting to Oldfather, while **Laura Dendyuk** was promoted to senior executive assistant and marketing coordinator.


David Oldfather

Brian Power, vice-president sales for **Techspan Industries** (www.techspan.ca), has announced the appointment of **Serge Day** to the position of regional sales manager for the province of Quebec and the Ottawa region. Day will be responsible for servicing and managing relationships with the distributor accounts in the region, as well as developing end user and contractor accounts for the Techspan brand. He has more than 20 years of sales experience, including time spent with Cooper Tools and Leviton. Agents in Quebec and Ottawa will report directly to Day.


Serge Day

Canlyte (www.canlyte.com), a division of Philips Electronics Ltd., has announced that **Jean-Claude Lesperance** will assume the role of senior sales manager for Eastern Canada. Lesperance has been in the lighting and electrical industry for more than 25 years with experience in the lamps and luminaries businesses, and electrical distribution and manufacturing. His background has been focused in sales and sales management, as well as project management. He will be responsible for sales strategy and development in Ottawa, Quebec and the Atlantic provinces.


Jean-Claude Lesperance

Philips Lighting Canada (www.lighting.philips.ca/en) has appointed **Denis Lavoie** to the position of senior director, sales, where he will oversee the commercial sales activities for the Professional Luminaires organization, including Canlyte, Daybrite, Ledalite and Lumec. Lavoie has been with the Philips Lumec organization for more than two decades, and was most recently the commercial general manager, Philips Lumec & Philips Roadway Lighting.


Denis Lavoie

Graybar Canada (www.graybarcanada.com) president and CEO **Frank Hughes** is retiring after 40 years with the company, effective January 5, 2012. Upon Hughes' retirement, **Peter Horncastle** will be named executive vice-president and general manager, assuming leadership of Graybar Canada. Hughes started his career with Harris & Roome Supply in 1972, holding positions in sales, branch management, and electronics and operations management. He acquired an ownership stake in the company and stayed with the organization after it was purchased by Graybar. Horncastle, meantime, has been with Graybar Canada since 1989, starting his career in the warehouse. He has since garnered a variety of experience, serving in counter and sales positions, as branch manager, sales and marketing manager, and regional vice-president.


Frank Hughes


Hannah Edmondson (left) and Jeff Krakowiak

Jeff Krakowiak, vice-president and general manager, Electrical Sector Canada, **Eaton** (www.eaton-canada.ca) is congratulating **Hannah Edmondson**, this year's recipient of the **Eaton Electrical Award of Academic Achievement**. Edmondson is a third-year student at McGill University in Montreal, Que. The award is part of the **Electro-Federation Canada (EFC) Foundation Scholarship Program** (www.electrofed.com/scholarship-program), which was established in 1995 to encourage Canadian students to pursue a career in the electrical, electronics and telecom industries.

Universal Lighting Technologies (www.unvlt.com) congratulates **Bernhard Hartmann** of **Osso Electric** (www.ossoelectric.com, member of Sonepar Canada) in Belleville, Ont., for winning the grand prize in the recent e-Learning Center challenge: a new 37-in. LCD Panasonic HDTV.


Lazar Petrov (left) and Jim Wamsley

As part of the challenge, every Osso employee in Ontario was eligible to receive $10, $25 and $50 Visa gift cards for completing online educational courses at Universal's e-Learning Center, but only one lucky person could win the random draw for the Panasonic television.

Osso's general manager, **Jim Wamsley**, handed out the gift cards, alongside **Lazar Petrov** with Universal Lighting Technologies and **Bill Eckersley** with **Humerlec**; then Wamsley drew Hartmann's name for the grand prize.

"We think it's important to reward sales staff for continuing their professional education," said Petrov. "We had a tremendous turnout for the e-Learning Center challenge at Osso, and we plan to repeat our success throughout the Canadian marketplace. We look forward to providing similar opportunities for additional distributors in 2012."

Alcan Cable has appointed **Todd Kirisits** to marketing manager-distribution for North America. In his new role, Kirisits is responsible for all marketing plans and promotional activities for the electrical distribution market in Canada. He will have an active presence in the Canadian market working with Alcan's Nual partners and contractors to provide Nual cable products for commercial, industrial, institutional and residential construction applications. Kirisits has worked with Alcan Cable for five years, and brings 18 years of sales and marketing experience.

Robertson Worldwide (www.robertsonww.com), a global manufacturer and supplier of electronic and magnetic ballasts and other lighting systems, has named **Pamela Stowers** its new director of marketing. According to the company, Stowers has accumulated a "wealth of experience" after having spent more than 10 years in the electrical and lighting industries, with companies such as A.L.P. Lighting Inc. and Fulham Co. Inc.

Halco Lighting Technologies (www.halcolighting.com) has named **Jill Mungovan** to the position of marketing director. She brings more than 12 years of lighting industry experience to the team, including eight years managing marketing departments in the commercial/industrial sector. Prior to joining Halco, Mungovan held several positions with Cooper Industries, and also served as marketing manager for Simkar Corp.


Jill Mungovan

Tom Shaffer, who joined the Alumen8 division of **Amerillum Corp**. as sales manager, has been promoted to director of sales for parent company **AmerillumBrands**, and its three manufacturing divisions: a•light, Alumen8A and Alumen8E. Shaffer is responsible for national sales planning, forecasting and sales force management for the three manufacturers. EB


Tom Shaffer

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

NETA PowerTest
InterNational Electrical Testing Association
February 27-March 1, Fort Worth, Texas
Visit www.powertest.org

ECAA 50th Anniversary Convention
Electrical Contractors Association of Alberta
March 2-12, Cabo San Lucas, Baha California
Visit www.ecaa.ab.ca

University of Industrial Distribution
Electro-Federation Canada (EFC)
March 5-8, Indianapolis, Ind.
Visit www.univid.org

The Work Truck Show
Nat'l Truck Equipment Assoc.
March 6-8, Indianapolis, Ind.
Visit www.ntea.com
EB WILL BE THERE!

94th CCA Annual Conference: "The Changing Face of Construction"
Canadian Construction Association
March 11-16, Savannah, Ga.
Visit www.cca-acc.com

IEEE IAS Electrical Safety, Technical and Mega Projects Workshop
March 19-21, Edmonton, Alta.
Visit www.ieee.org/estmp
EB WILL BE THERE!

LEDucation 6
Designers Lighting Forum of New York
March 21, New York, N.Y.
Visit www.leducation.org

AEL Electrical Learning Expo
Alberta Electrical League
March 22, Grande Prairie, Alta.
Visit www.elecleague.ab.ca
EB WILL BE THERE!

Ontario Feed-In Tariff Forum
April 3-4, Toronto, Ont.
Visit bit.ly/vgjkE7

Light+Building
April 15-20, Frankfurt am Main, Germany
Visit www.light-building.com

Energy Trade Fair
April 23-27, Hannover, Germany
Visit www.hannovermesse.de/en/energy

A-D Electrical Supply Division: Spring Network Meeting
Affiliated Distributors
April 23-25, Phoenix, Az.
Visit www.adhq.com

BICSI Canadian Conference & Exhibition
April 29-May 2, Niagara Falls, Ont.
Visit www.bicsi.org
EB WILL BE THERE!

MEET 2012
May 2-3, Moncton, N.B.
Visit bit.ly/MEETMoncton
EB WILL BE THERE!

IEEE PES Transmission & Distribution Conference & Exposition
IEEE Power & Energy Society
May 7-10, Orlando, Fla.
Visit www.ieeet-d.org

CanSIA's Solar Ontario
Cdn. Solar Industries Assoc.
May 9-10, Windsor, Ont.
Visit www.cansia.ca
EB WILL BE THERE!

Lightfair
May 9-11, Las Vegas, Nev.
Visit www.lightfair.com
EB WILL BE THERE!

OEL Electrical Industry Conference
Ontario Electrical League
May 9-12, Ottawa, Ont.
Visit www.oel.org
EB WILL BE THERE!

RON COLEMAN, B. Comm., FCCA CMC

Critical Success Factors and Key Performance Indicators

Golfers are fanatical about measuring. I am not so sure how they are at managing, though, because most of them seem to perpetually complain about bad rounds, yet they keep going back for more... such dedication! There's nothing more tedious than getting cornered by a golfer who wants to tell you about his latest round, which is why I try to turn the conversation around to see how they measure their business success.

The conversation tends to dry up fairly quickly.

In truth, golfers might be happier people were they to stop measuring their scores. This is true of a lot of contractors; they don't measure their business score and, so, go through life blissfully unaware of just how badly they are doing until, one day, everything crashes down around them. Then they wonder what happened.

I ask my contractors to identify the elements of their businesses where they should be keeping score. These are called Critical Success Factors (CSFs), and we usually come up with the following:

1. Level of sales
2. Profit
3. Cash flow management
4. Marketing strategies
5. Their team
6. Communications
7. Having fun (I make sure they add this one!)

The next step is getting them to identify numeric outcomes for each of these CSFs. Once we've established those, they come to the realization that you cannot measure and manage the progress of those CSFs as they are; they must first be broken down into smaller elements that can, in fact, be measured, and show contractors how they are progressing. It is not unlike the process for ISO management: when each step is done correctly, the desired outcome is achieved.

You can only manage what you can measure

I take contractors through those smaller elements, which are called Key Performance Indicators (KPIs). Each CSF will have several KPIs associated with it, and we put values to those. It is the KPIs that we measure and manage. (I explore this in more detail in my book "Becoming Contractor of the Year".) By achieving the KPIs, we achieve our CSFs.

Here is a short example:

Critical Success Factor
- Annual sales of $3 million

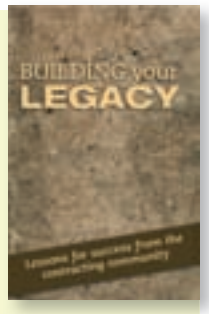
Key Performance Indicators
- 50-75 active leads
- 6-10 outstanding proposals
- Minimum 45% closure percentage/conversion rate
- Minimum $400,000 work on-hand
- 25% product upselling/change orders of work on-hand

The idea is simple: when any of those KPIs are out of line, you focus on them and work on getting them to acceptable parameters. If you cannot, then you know you won't reach your projected sales and need to revise your business model. If you exceed the KPIs, you know you need to either reschedule work or take on more resources.

This is a difficult sell to most contractors, and that's another reason why only 25% of contractors make super profits. You have to really want it!

Those who follow the process really like it; their supervisory time goes way down, they are less stressed and they get better results.

The Takeaways
- Do you know the Critical Success Factors for your business?
- Do you know your Key Performance Indicators?
- Do you measure and manage? EB



Ron Coleman, a member of the Institute of Certified Management Consultants of British Columbia, just published his latest book, "Building Your Legacy: Lessons for Success from the Contracting Community", which teaches you how to make more money while having more fun. A noted speaker, he has completed many interfirm financial comparisons of groups of construction companies in Canada and the United States. Ron's numerous published education programs include a 36-hour business management course specifically designed for the Electrical Contractors Association of British Columbia (ECABC). Visit www.ronaldcoleman.ca.

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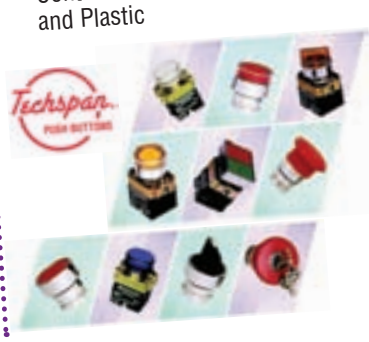

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Dave Smith

CSA Z462 wants you to realize that arc flash calculations are not an exact science, and to understand there is inherent risk in everything we do.

Entering indoor substations

Part eight

(At the end of Part 7 "Entering indoor substations" in January 2012, Dave explained the importance of getting in and out of a substation as quickly as possible, and always knowing where you are in relation to any machine.)

In previous columns, I've written about my belief that you don't want to be in a situation where an exploding door—whether it's being blown open or blown off its hinges—can hit any part of your body. When dealing with a substation, you're facing thousands of horsepower worth of energy and explosive action.

You do not want to be in a situation where any part of the metal containment system hits your body, so follow the safe work practices I've preached in previous columns.

The task of racking equipment in or out is a much higher risk; you need to be very capable of following switching orders and reading a single-line diagram. Find the single-line diagram for the substation, look at it, then look at the equipment to correlate the two so you know how the substation operates, and triple-check to make sure you are at the right gear.

Look at the front of the switchgear to see whether an arc flash hazard study has been done on the substation; you want to know the IE, minimum required PPE and the flash boundary.

It is important to understand that ATPV (Arc Thermal Performance Value) or EBT (Energy Break-open Threshold) ratings of your clothing are based on a 50% probability. Were we playing Texas hold 'em, 50% probability means "All in" but, in electrical safety, 50% is a coin toss and definitely not worth the risk.

So understand that, while personal protective equipment (PPE) manufacturers try to make their gear as protective as possible, CSA Z462 wants you to realize that arc flash calculations are not an exact science and to understand there is inherent risk in everything that we do.

When you are the person racking something in or out, one of the most critical things to ensure is that you have personal (local) control over the system. I tell the story of an operator who was closing a starter while someone else was hitting a remote switch. The switch closed just as the starter was racking to the bus bar. This starter design has a mesh grill on the front of it, and the unfortunate operator was subjected to an arc flash blowing out through the metal grill. Luckily, his Category 2 coveralls protected him; had he been in street clothes with a combination of polyester and cotton, it is highly likely he would have been blown straight to the burn ward... perhaps the morgue.

You must know how to put an individual piece of equipment into local control; if you don't know how, then you simply are not qualified to operate the equipment. A great deal of equipment now is PLC-controlled, and even when Off, it may be energized.

You must understand the starting process for the equipment you're operating. Be they low- or high-voltage, you must know whether the disconnect switches you're operating are load-break or non-load-break switches. There have been hundreds of horror stories in our electrical history where unwitting, unknowing or untrained people have tried to operate non-load-break switches under load conditions.

You cannot bring the blades out of the jaws fast enough to extinguish an arc with this equipment; it was never designed to do this. Opening non-load break switches under load merely draws an arc that can go phase-to-phase and phase-to-ground, causing an immediate explosion.

Make sure you know the equipment, that you're following safe work procedures and practices, and that you're wearing the correct PPE.

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) available to you. Feel free to use them to support your own safety program and other initiatives.

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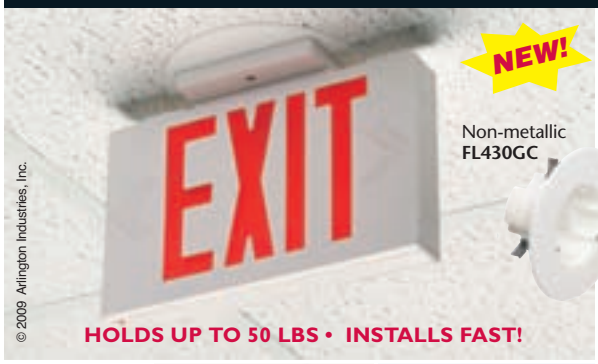

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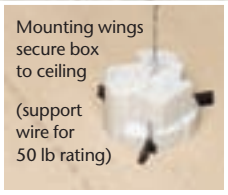

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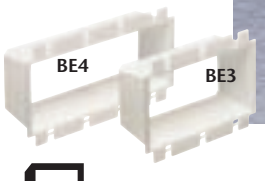

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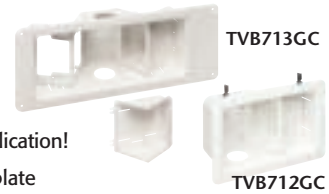

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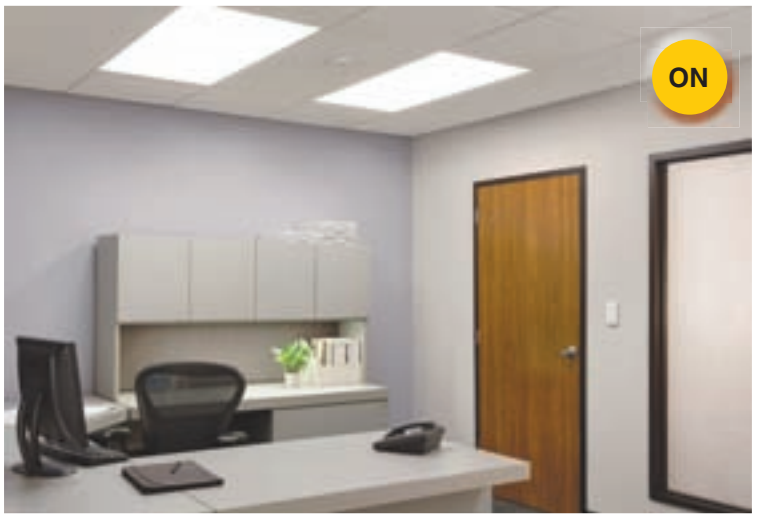
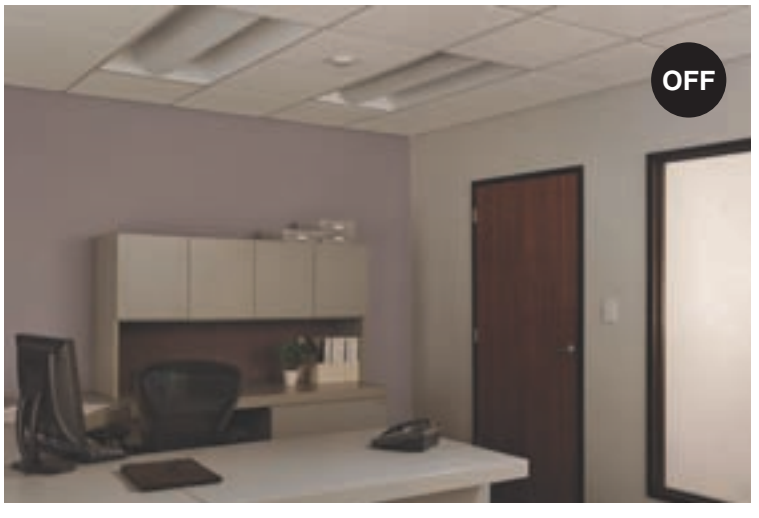
Well-designed lighting controls help achieve LEED certification

Michael Jouaneh, CEM, LEED AP BD+C





As more buildings and interiors seek LEED certification, it's worth noting the central role well-designed lighting plays in a sustainable facility. In this article, we'll look at LEED and its goals, and how lighting industry professionals can guide a project team toward an optimum number of LEED points by focusing on lighting control to reduce energy use and to create a healthier interior environment.

The basics: what is LEED?

Leadership in Energy and Environmental Design (LEED) is a green building rating system started in 1998 and administered by the United States Green Building Council (USGBC). Canada has an offshoot: CaGBC. LEED provides an objective standard for what constitutes a "green" building, and offers a set of scientifically based performance criteria for building certification.

The LEED Green Building Rating Systems address seven topics; within each topic are credits, and meeting the goals of these credit earns a facility a certain number of points. The total number of points earned determines whether the facility will achieve LEED certification, and at what level.

The first topic, Sustainable Sites, guides the project team toward selecting responsible and environmentally friendly site selection and design strategies. Water efficiency requires efficient water use and conservation. The topic where lighting plays the biggest role, Energy and Atmosphere, provides a framework for optimizing whole-building energy efficiency. Materials and Resources promotes responsible waste management and materials selection. Another key area for lighting, Indoor Environmental Quality, seeks to minimize contaminants and optimize the indoor environment, which includes the use of lighting controls and daylighting. Innovation in Design is a small category that rewards exemplary performance above LEED requirements, as well as green building innovation. Finally, Regional Priority provides an incentive to achieve LEED credits that are important to the local geography.

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LEED 3.0 is the current version; the next version is due at the end of 2012. Initial reviews of the next version show lighting control will remain a major contributor toward achieving LEED certification.

LEED and lighting control

Let's look more closely at the topics where lighting control can make an impact. Lighting controls can contribute to the achievement of 40 out of a possible 110 points in the LEED NC (New Construction) rating system. (Note that use of any products will not guarantee any LEED points; products may have to be combined with other solutions to meet the full requirements for each credit.)

Sustainable Sites, Credit 8, Light Pollution Reduction (1 point)

The intent of this credit is to "minimize light trespass from the building", and requires that no interior lights shine out the windows, or that all non-emergency interior lighting power is reduced by at least 50% during non-business hours. Additionally, exterior lighting must comply with ASHRAE 90.1 2007 "Lighting Power Densities" (W/sf) as well as the lighting zone requirements in IESNA RP 33.

Lighting control contributes to achieving this one-point credit in several ways. First, controllable window shades with the right fabrics prevent light from escaping through the windows of the building. Occupancy sensors can turn lights Off when spaces are vacant to not only save energy but to prevent light pollution from escaping the building. Timeclock scheduling can be used to provide a building lighting sweep at night so that lights are Off or set to a dimmed level at certain times, saving energy and preventing light pollution.

Energy and Atmosphere, Prerequisite 1, Fundamental Commissioning

The intent of this prerequisite is to "verify that the building's energy systems are installed, calibrated, and perform according to owner's requirements, basis of design, and construction documents". The credit requires the project team to develop a commissioning plan, and verify the installation and performance of systems to be commissioned.

Although this prerequisite does not award points, it is necessary for achieving LEED certification. Lighting control supports the prerequisite when the lighting control manufacturer offers commissioning in the field.

Energy and Atmosphere, Prerequisite 2, Minimum Energy Performance

Another prerequisite, Minimum Energy Performance, seeks to establish a minimum level of energy efficiency for the building. It requires the project team demonstrate a 10% minimum energy reduction compared to an ASHRAE 90.1 2007-compliant building. The building must also comply with the mandatory lighting control requirements in Section 9.4 of ASHRAE 90.1 2007.

To meet these requirements, lighting designers and specifiers can use occupancy sensors and timeclock scheduling to meet the mandatory lighting control requirements in Section 9.4 of ASHRAE 90.1 2007. Using a combination of energy-saving light control strategies such as automated shading, daylight harvesting, high-end trim, light level tuning, dimming, scheduling and occupancy sensing can reduce lighting loads by 60% or more. These strategies can also reduce HVAC loads by 20% or more.

Energy and Atmosphere, Credit 1, Optimize Energy Performance (1-19 points)

Energy and Atmosphere Credit 1 is where lighting control makes the biggest impact by far, with the opportunity to earn up to 19 points based on energy savings. The intent of this credit is simply to have the building achieve energy performance beyond the prerequisite standard. This requires a whole-building energy simulation to show energy performance better than ASHRAE 90.1 2007 by at least 12% (8% for renovation). Note that automatic shades—not manual shades—may be used in the energy simulation.

To help meet this requirement, occupancy sensors and timeclock scheduling can be used to meet the mandatory lighting control requirements of ASHRAE 90.1 2007 Chapter 9. Combining energy-saving light control strategies such as daylight harvesting, high-end trim, light level tuning, dimming, personal light control, scheduling, automatic shading and occupancy sensing reduces both lighting and HVAC loads for a total building energy reduction of 30% or more.

Energy and Atmosphere, Credit 3, Enhanced Commissioning (2 points)
This credit is designed to provide an incentive for taking a more in-depth approach to system commissioning. The intent is to begin commissioning early in the design process and execute additional activities after systems performance verification has been completed. LEED requires that the project team develop a systems manual, verify that the requirements for training operating personnel are in place, and to review building performance within 10 months of substantial completion.

Lighting control contributes to this credit provided the manufacturer can provide field service, and can train and provide necessary manuals to operating personnel.

Energy and Atmosphere, Credit 5, Measurement and Verification (3 points)
The intent of this credit is to provide ongoing accountability of building energy consumption over time, and requires the project team to develop and implement a measurement and verification (M&V) plan to monitor building electricity consumption. The M&V plan must cover at least one year of post-construction occupancy and provide a process for corrective action should the M&V results not show energy savings.

Lighting control technology exists to provide power monitoring for the continuous lighting energy consumption and savings data for the M&V plan. Strategies like light-level tuning can be easily implemented to provide necessary corrective action to achieve the desired energy savings.

Material and Resources, Credit 4, Recycled Content (1-2 points)
This credit is designed to increase demand for building products that incorporate recycled materials. To that end, the facility is required to use materials such that the sum of the recycled content constitutes at least 10% or 20% (based on cost) of the total value of the material cost in the project. 10% recycled content will earn one point, and two points will be awarded for 20% recycled content. Using controllable window shades made with recycled fabric will contribute to building up the percentage of recycled content.

Interior Environmental Quality, Credit 6.1, Controllability of Systems—Lighting (1 point)
The intent of this credit is to provide a high level of lighting system control for individual occupants or groups in multi-occupant spaces (i.e. classrooms, conference rooms) and promote their productivity, comfort and well-being. To deliver this control, LEED requires the design provide individual lighting controls for at least 90% of the occupants to suit individual task needs and preferences, and provide lighting control for all shared multi-occupant spaces to allow for adjustments to meet group needs and preferences.

The credit requires the project team to develop a commissioning plan, and verify the installation and performance of systems to be commissioned.

Displaying the energy savings from the lighting control system, publishing case studies about the facility, and giving tours can help achieve innovation point for Green Education.

Lighting controls (such as dimmers, preset multi-scene controls, hand-held remote or PC-based controls) that allow occupants to select their appropriate light levels help achieve this credit, provided they are made available to occupants.

Interior Environmental Quality, Credits 8.1 Daylight and 8.2 Views, (1–2 points)
Daylight can be a big part of lighting design, and these two credits are an opportunity to maximize the use of windows. The purpose of these credits is to provide occupants with a connection to the outdoors through daylight and views into regularly occupied spaces. This is achieved by providing at least 75% of regularly occupied spaces with daylight illumination at a minimum of 25 fc.

The second part of the credit requires achieving a direct line of sight to the outdoors using vision glazing between 30-in. and 90-in. above floor for occupants in 90% of all regularly occupied areas, and to provide glare control. Automated windows shades are an ideal way for designers to control glare while still providing daylight and access to views.

Regional Priority, Credit 1 (1-4 points)
This credit category identifies LEED credits that are important for a particular geographic region. These are not new credits but existing LEED credits that are deemed important to a project's location. One point is awarded for each regional priority credit achieved up to a total four points. Many of the credits mentioned above are considered regional priority credits that can give you up to four bonus points by achieving them.

Innovation in Design, Credit 1, Innovation in Design (1-5 points)
An opportunity to get creative, Innovation in Design awards up to five additional points for exceptional performance above LEED requirements and/or innovative performance in green building categories not addressed by LEED.

Lighting controls can be used to help get some of these innovation points. For instance, displaying the energy savings from the lighting control system, publishing case studies about the facility, and giving tours can help achieve innovation point for Green Education.

Innovation in Design, Credit 2, LEED AP (1 point)
If you haven't attempted to earn a LEED-AP credential, this is an incentive. The credit is intended to support and encourage design integration required by LEED and streamline the application certification process. Getting this point is simple. At least one principal participant on the project must be a LEED-AP.

Wrapping up
LEED is the preeminent set of guidelines for showing whether a building is sustainable. Without a sustainable approach to lighting design through thoughtful light control, achieving LEED certification is much more difficult. EB

Michael Jouaneh is a marketing manager with Lutron (www.lutron.com), primarily focusing on energy conservation and sustainability. He is active in the development of energy and green building codes/standards, and is the author of several published articles, white papers and case studies on high-performance green buildings. Michael is also a frequent presenter at industry events, such as Lightfair and Greenbuild.

Overhead cabling saves energy in data centres

Victor Avelar

Although not considered a best practice from an energy efficiency point of view, a common method for cooling data centre equipment is to employ a raised floor as a plenum for the delivery of cold air to server intakes. The cold air is forced underneath the floor by fans within air handlers. However, this method is not the only option. Many new data centres today forgo the expense of the raised floor and place equipment on a hard floor. They cool their servers by employing in-row, overhead or room air-conditioning with hot aisle containment. The hard floor approach also forces the issue of placing cables overhead and many data centres have become accustomed to working with overhead cables.

In both cases, data centre owners have to resolve the issue of how to lay out power and data cables. Data centres that depend on raised floor cooling distribution often route network data and power cabling underneath the raised floor. This cabling then feeds individual IT racks through cable cutouts at the back each rack. These cable cutouts allow cold air to bypass the IT server inlets at the front of the racks and mix with the hot air at the back of the rack. This design practice can lead to hot spots, clogged floors and overall lower cooling system efficiency.

Raised floors filled with cabling and other obstructions make it difficult to supply cold air to racks. The raised floor cable cutouts necessary to provide cable access to racks and PDUs result in a cold air leakage of 35%. The cable blockage and air leakage problems lead to the need for increased fan power, oversized cooling units, increased pump power and lower cooling set points.

Meantime, placing data centre power and data cables in overhead cable trays instead of under raised floors can result in an energy savings of 24%. This paper analyzes the effect of underfloor cabling on cooling and on electrical consumption, and shows how placing network data and power cabling in overhead cable trays can lower cooling fan and pump power consumption by 24%.

Underfloor cabling energy waste

Underfloor cabling contributes to energy losses in three ways:

- Blockage of air due to cables.
- Bypass air from rack cable cutouts.
- Bypass air from power distribution unit (PDU) cutouts.

Blockage of air due to cables

When new network or power cables are added under the floor, older unused cables are rarely pulled out to make room. Instead the cables are left undisturbed to minimize the risk of downtime. The build-up of cables causes blockages in air flow, which contribute to hot spots in the data centre.

A common solution is to add more air conditioning—not for cooling capacity, but for extra fan power to increase static pressure and overcome the underfloor blockages. The raised floor hides the build-up of cables over time. In contrast, overhead cabling is visible and more likely to be properly maintained and managed over the years.

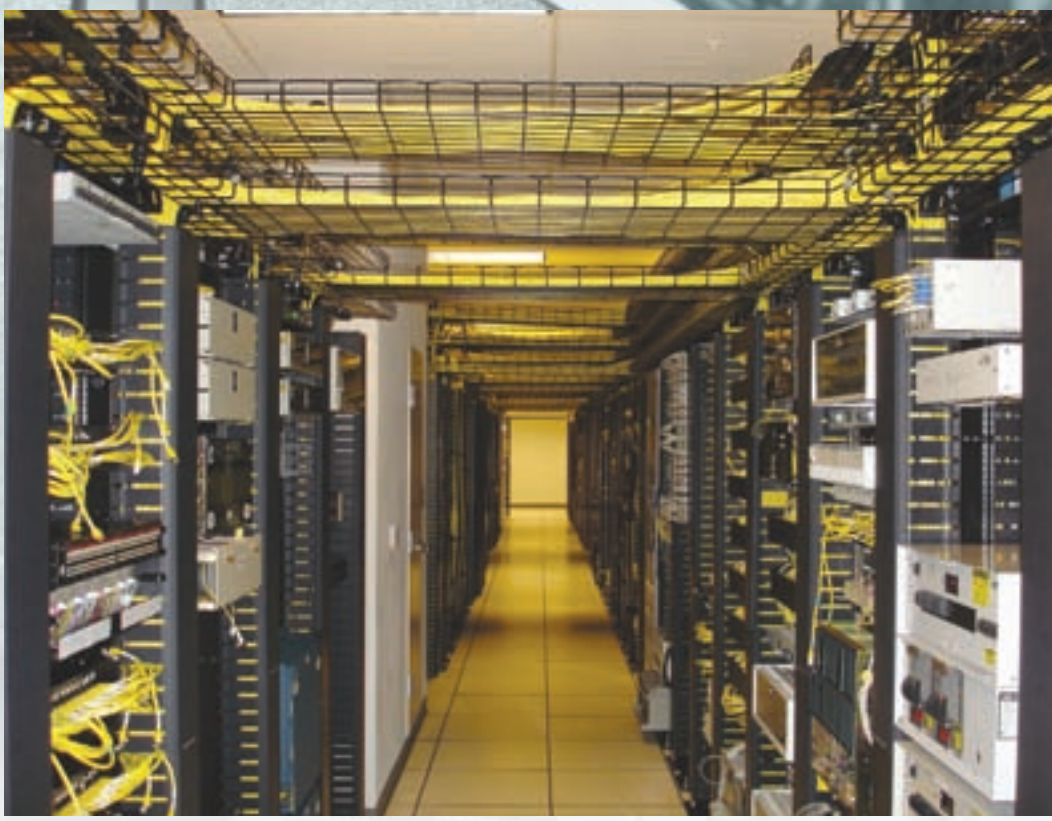


Photo courtesy TE Connectivity.

TABLE 1

Location	Under floor		Overhead	
	m^3 (ft^3)	% leakage	m^3 (ft^3)	% leakage
Behind IT racks	15	33%	0 (0)	0%
Under PDUs	2 (20)	4%	0 (0)	0%
Behind CRAHs	8 (88)	18%	6 (65)	13%
Total	25	55%	6 (65)	13%

TABLE 2

	Under floor	Overhead
Rack inlet air	18.3°C	20.0°C
CRAH supply air	17.7°C	19.4°C
CRAH return air	23.0°C	29.6°C
CRAH delta T	5.3°C (9°F)	10.2°C
Number of CRAH units	42	31
Fan power consumption	160kW	118kW
Pump power consumption	20kW	19kW
Total power consumption	180kW	137kW
% power savings	24%	

Bypass air from rack cable cutouts

Underfloor cabling requires that cables come up through the floor tile and through the bottom of the rack. Cable cutouts in the tile measure about 8 x 8 in., and are only partially filled with cabling. The remaining space is usually left open, allowing cold air to leak into the hot aisle (assuming a hot-cold aisle layout).

The hot aisle should be the space where the hottest air in the data centre makes its way back to the computer room air handler (CRAH). The cold air that leaks into the hot aisle lowers the air temperature back to the CRAH, which decreases its capacity to remove heat. For example, a CRAH unit with 27ºC return air temperature provides 70kW of heat removal capacity. However, at a return air temperature of 22ºC, the heat removal capacity drops to 43kW. The capacity lost due to bypass air may create hot spots, which are sometimes addressed by adding more CRAH units.

Bypass air from PDU cutouts

Many PDUs are configured with four 42-position panels, which means up to 168 individual circuits can be distributed to the IT racks. In addition to these conductors, large input conductors feed the PDU. The installation and removal of these conductors requires a 9-sf to 16-sf opening underneath the PDU. This bypass air from around conductors has the same negative effect on the cooling system efficiency as the bypass air from rack cable cutouts.

Energy savings with overhead cabling

The energy savings attributed to overhead cabling are derived from lower fan and pump losses. Chiller energy cost savings can also be realized when the chilled water supply temperature is increased. A hypothetical data centre was modelled to evaluate the savings in moving network and power cables to overhead cable tray. The assumptions used for the analysis include the following:

- Data centre capacity: 1 MW
- Cooling system: chilled water
- Constant speed CRAH fans
- Rack inlet temperature with underfloor cabling: 18ºC
- Rack inlet temperature with overhead cabling: 20ºC
- Average rack density: 2 kW/rack
- IT Equipment ΔT: 11ºC
- Quantity of IT racks: 500
- Average cable cutout area per rack: 0.33 sf (a conservative figure, since the 8 x 8-in. cutout is partially filled with cabling)
- Total rack cable cutout area: 167 sf
- Minimum airflow required for IT: 120,038 cfm
- Hot air recirculation: 5% of airflow required for IT
- Average cfm at the front of each rack: 240 cfm
- Open area of 25% open perforated tile: 1 sf
- Average velocity at the front of each rack: 240 ft/min

In this analysis, a 1-MW data centre at 100% load is assumed to have 500 IT racks at an average power density of 2 kW/rack. Table 1 shows the calculated area of open tile cutout space and the associated air leakage as a percent of total required IT airflow. It is clear the cable cutouts behind IT racks contribute the largest amount of cold air leakage in data centres with raised floor cooling.

Moving the power and data cabling overhead reduces the total leakage to 13%. This reduction in leakage causes the CRAH return temperatures to increase, which then increases the cooling capacity of each individual CRAH. Ultimately, this reduces the number of CRAH units required.

Table 2 shows the design conditions modelled for the underfloor and overhead cabling scenarios. The temperatures for the rack inlet air and the CRAH supply and return air are based on energy balance equations which account for hot and cold air leakage. In this analysis, the number of CRAH units was reduced from 42 to 31. This leads to an estimated 24% savings in fan and pump power.

This analysis does not include the benefit of reduced air blockages under the raised floor. Removing abandoned cabling under the floor would have increased the energy savings stated above. In addition to the energy savings, significant capital cost savings are realized by foregoing the cost of 11 extra CRAH units—an estimated savings of $90,000. Finally, the analysis assumed the same chilled water supply temperature for both scenarios. In cases where the chiller is dedicated to the data centre, the chilled water temperature could be increased, thereby further increasing chiller efficiency and overall savings.

Spaghetti anyone?

Even overhead cabling can develop the problem of cable "spaghetti"—a huge bunch of cables, entangled with each other. When this occurs, new cable cannot be laid because it is impossible to pull out "dead" cabling from the pile of existing cables. Cable trays begin to sag under the weight of cables, and this increases the risk of a fault in equipment operation.

Consider a row of racks full of servers and networking equipment. Cables connected to panels and servers are laid on top of the racks in trays. When a contact breaks, the connection between two points is lost. When this happens, it is impossible to find or remove the faulty cable because it difficult to locate the defective cable within the mass of tangled cables. In these cases, new cable is often laid between the two points, but the old, defective cable is left inside. Over the course of time, this cable clutter results in 80% of dead cables being left in place, while the total quantity of cables increases.

Gradually, cable tray supports cannot carry the increasing load and more supports must be installed. In addition, no space is left under the ceiling because of the fact that cable bundles are all laid on one level.

The solution to this dilemma is to organize cable in trays mounted at different levels. Multi-level cable tray organization allows data centre personnel to sort and plan cable location, integration and removal on an ongoing basis. When a dead cable needs to be removed, it will not be tangled or buried. It will be easy to extract the cable from a single small bundle.

As the data centre changes, equipment moves in and out, and new components are added and removed. These changes result in frequent modifications to cables, which is why it is important the cable tray system be designed to accommodate such changes. New tray infrastructure must be compatible and interchangeable with the old system. The overhead tray system has to be flexible enough to transform without any fundamental changes in the original system.

Conclusion

Significant energy waste occurs in data centres when cable congestion forms air dams beneath the raised floor and cable penetrations in the raised floor tiles allow the cold air to escape and mix with the hot air. Modelling and analysis show that the decision to place network data and power cabling to overhead cable trays can lower cooling fan and pump power consumption by 24%.

It is possible to run cables overhead thereby saving energy and improving reliability through improved cable maintenance practices. Running structured cabling and power cabling in overhead cable trays results in several benefits. Raised floor plenums have less impedance to air flow when they are free of cables, and less air leakage occurs because the raised floor would have no holes designed to accommodate cabling. As a result, less fan energy would be required to cool servers. The decision to place cables overhead also provides one less reason to absorb the significant expense of a raised floor.

Overhead cable tray technology has made advances in recent years. These systems are now modular and much more flexible to accommodate dynamic data centre environments. Sound cable practices include the deployment of multi-layered overhead cable tray systems. EB

Victor Avelar is a senior research analyst at Schneider Electric's (www.schneider-electric.ca) Data Centre Science Centre. He is responsible for data centre design and operations research, and consults with clients on risk assessment and design practices to optimize the availability and efficiency of their data centre environments. Victor holds a bachelor's degree in mechanical engineering, and is a member of AFCOM—an association of data centre management professionals.

Photo courtesy Erico.

LIGHT LAYERING:

Jeffrey Dross

As little as 10 years ago, residential lighting was relatively simple. It used to be that, in almost every room, an electric box was placed in the centre of the ceiling and a single lighting fixture was installed. No longer.

Lighting has become a part of the aesthetic make-up of the room and the one-size-fits-all solution has disappeared. Still, it need not be complicated. Adding great light to a home is as simple as A-B-C. To create interesting environments in every room, plan lighting across the following three layers:

A - Ambient or general lighting. Every room needs general illumination. This layer provides the room with an even spread of functional light on which to build.

B - Task lighting. Whether your task is food preparation, reading or applying make-up, good lighting is required. This layer pinpoints light for a specific task.

C - Accent or decorative lighting. This layer of light adds interest to the interior space and supplements the décor of a room. While not essential, it can easily distinguish one home from another.

Ambient lighting

Today, ambient lighting is most often accomplished with recessed cans. When spaced correctly, ambient cans provide a very effective light source. While there are many rules-of-thumb used for placement, most are incorrect. Because proper recessed can location can be complicated, Michael De Luca has developed an almost perfect quantity and placement methodology in his book, "Kitchen and Bath Lighting... Made Easy". If you are installing recessed lights, get it right by following his rules.

Recessed lighting can be effective, but is often mundane. To add more style to the room, flush-mounted or semi-flush lighting fixtures should be considered. Semi-flush fixtures can be especially useful in tall-ceiling applications, as they bring the light down further into the room. Many sizes, styles and colours are available to complement the home's design. Using something other than recessed light will set the décor apart from the norm.

Ambient lighting is often needed in new luxury baths and master suites because the size of these rooms continues to grow. Stretching the bedroom's reading lights to also serve as ambient light may not work. Consider a separate light source in these rooms. Remember, when there is too much lighting, it can always be switched off!

Task lighting

Task lighting is likely the most important light source in a home. Each room typically requires a unique luminaire to service the primary task. Carefully consider the task and the way in which the homeowner uses the space to properly specify task lighting.

In the kitchen, the primary task is food preparation, and one recommended light source for this task is undercabinet lighting. Modular undercabinet lighting puts the light source at the front of the counter, but may be complicated to install. Direct-wire undercabinet lighting is quite common, but the light is concentrated toward the rear of the counter. Direct-wire systems deliver a smaller amount of light to the front of a counter when compared with a modular solution. It is adequate light but, given a choice, should only be selected when a modular system is impossible. Undercabinet lighting serves a similar purpose in the laundry room, where the task is folding laundry and ironing. The same rules apply.

In the bath, the primary tasks are shaving and make-up application. These bathroom tasks are best accomplished with light surrounding the face from three directions. Think of the light-surrounded make-up mirrors used in Hollywood and on Broadway. The best choice is one light on each side of the mirror with the addition of, if possible, a light above the mirror.

A single source over the bathroom mirror—found so frequently in homes today—is the least-effective solution. Light from above causes glare and leaves the face with areas hidden in shadow. This glare is increasingly difficult for aging eyes to process. Good bathroom lighting can make a substantial difference to one's appearance and should always be carefully considered, especially when developing an age-in-place interior.

The task in an office, den and living room is usually reading. A table lamp or floor lamp fills this need nicely. Proper positioning of the lamp increases its effectiveness. A desk lamp should be placed 16 in. above the work surface and 13 in. from the front of the desk. The bottom of the lampshade on a floor lamp should be 42 in. above the floor and located behind or to the side of the chair.

Accent lighting

Accent lighting is the jewellery of a room. Like personal jewellery, it is not necessary, but makes a significant difference toward outward

lighting as simple as A-B-C

appearance. As designers increasingly use light as an aesthetic element, new types of lights are continually being developed and light is becoming more common in new places. As technology shrinks the light source, light can be brought to smaller locations.

Lighting above cabinets increases the visual size of the room as it transforms a heretofore dark area. Inside a lighted cabinet, sparkling stemware, collectable artifacts or colourful dinnerware pops like an inspired painting. Inside a lighted bookshelf, titles are easy to read. Toekick lighting defines the floor space and serves as a wonderful nightlight for easily navigating kitchens and bathrooms during the night. Lighted tray ceilings or coves add prominence to the centre chandelier of a dining room or foyer while reflecting light off the ceiling (a.k.a. "fifth wall") of the room. Uplit baseboards bathe the walls with an unusual lighting effect that can be matched by no other method. Lighting positioned under the lip of a counter pours light down the face of the cabinets, but also serves as a spotlight inside once the top drawers are opened, improving visibility.

In a luxury bath, a miniature chandelier over the soaking tub adds luxury for a more peaceful retreat. A full-sized chandelier in the centre of a master suite brings opulence to the owner's hideaway. Both of these are ways to provide functionality while elevating the aesthetics of the room.

Accent lighting is only limited to the designer's or homeowner's imagination. With long-lasting LED lighting now more affordable than some incandescent fixture types, it is possible to include lighting in areas where bulb replacement may be an issue, such as hard-to-reach areas and behind translucent tiles on the wall or floor. The game is changing as technology matures. The benefactor is the style-loving homeowner.

All for one, or one for all

In many rooms and homes, because of budget or size, a single light source must do double- or even triple-duty. In these cases, it is important to define the primary reason for the light. For example, many powder rooms or guest baths have become a showplace rarely used by the homeowner. These little rooms are often highly decorative and exemplify the good taste of the owner. Guests will visit this room for a short time, checking their appearance in the mirror and then exiting. Lighting should be selected primarily for its visual significance. Yes, it must light the mirror and allow guests to find their way in and out without tripping, but the light should be selected as an accent piece.

Lamps set around a study or library for reading also serve as ambient light and, when properly selected for their outward design, will fit into the room's décor. Again, one luminaire serves multiple functions. Hallways typically need good ambient light because the task in a hallway is navigating from room to room. Adding accent lights to cove moulding or behind baseboards makes hallways memorable.

Switches

A discussion on layering light is not complete without including the importance of proper switching. Each layer of light should be controlled with a separate switch. When multiple accent layers are employed, it is best when they are controlled individually. When rooms are exceptionally large, geographic separation may also be considered. With a full complement of switches, multiple room environments can be created.

For example, when the kids are doing homework in the dining room, owners will want to turn on all the lights. A romantic dinner for two at home requires only the elegant glow of the chandelier. Elegant entertaining demands the addition of pin-spots over the table, alongside the chandelier. The room will look stunning, guests will appear their best under the complementary light and adequate illumination will be provided for the visibility required to scoop the food onto the plate (and protecting the Oriental rug below!). In most cases, when correct switching is provided, there is a large enough variety of light combinations from which to choose so that dimmers are not needed, though they may be desirable.

A-B-C

With a small amount of planning, light can be used to produce stunning effects. Good lighting can make an average room look better and a great interior design look remarkable. The key to successfully lighting is considering all three layers. Ensuring all three layers are addressed will provide a space with light that serves both function and beauty. Combining those layers with appropriate switches makes the room efficient and appropriate for any event. What more could be asked of a simple light bulb? EB

Jeffrey R. Dross of Kichler Lighting (www.kichler.com) has been involved in nearly every facet of the lighting business. He currently serves as Kichler's corporate director of education & industry trends, and continues to serve as an oft-quoted media spokesperson. Jeff is a past chair of the Manufacturers & Suppliers Advisory Committee of the National Kitchen & Bath Association.

Generating injury-free success through safety fundamentals

Edison Mission Group (EMG) manages the competitive power generation business and other subsidiaries of California-based Edison International, a generator and distributor of electric power and an investor in infrastructure and energy assets, including renewable energy.

Edison company Midwest Generation is an independent power producer that operates six electric power generating plants in Illinois and supervises operation of the EME Homer City generation plant in Homer City, Pa. It sells electricity in competitive wholesale markets and competes in a 13-state region that extends from the Atlantic coast westward to Illinois.

Situation

In 2006, Midwest was facing an increase in the severity of injuries—including fatalities—at its coal-fired plants. Senior leadership at Edison and Midwest, including Len Tully, safety director, Guy Gorney, former senior vice-president of generation, and Ted Craver, then president and CEO of Edison Mission Group (now chair of Edison International), asked DuPont to assist the organization in moving toward "world-class safety performance".

During the three-year engagement that followed, DuPont:

- Evaluated Midwest's safety management system against first-class systems.
- Identified opportunities for improvement in the management of workplace safety and process safety.
- Provided recommendations for the development and maintenance of a first-class safety system at Midwest.

Initial assessment findings

As a first step, Edison and Midwest management undertook a comprehensive assessment with DuPont that identified key areas of concern and opportunities for improvement:

- Midwest's safety culture was reactive and compliance-focused.
- There were pockets of safety system skills in the organization (such as the incident investigation process and its safety committees), but these were insufficient to achieve the highest standards of safety performance.
- Established safety goals encouraged only incremental improvement.
- Midwest lacked sufficient safety management knowledge to achieve first-class safety performance.
- There was a significant gap in the organization's ability to identify and mitigate risk.
- Inconsistent safety management practices were a barrier to rapid improvement (i.e. more difficult, more expensive, slower).
- Midwest's primary goal was improving the overall safety and welfare of employees.

Primary goals

The DuPont assessment was designed to help Midwest develop a high-level path forward for continuous safety improvement over the three-year engagement period of 2007 to 2010. Midwest and DuPont agreed that the primary goals of the engagement were to:

1. Reduce employee injuries and, ultimately, create an injury-free workplace.
2. Transform the safety culture from one that was reactive, compliance-focused to an interdependent one (as defined by the DuPont Bradley Curve) that is proactive.
3. Develop the skills and capabilities of the line organization to more effectively manage all aspects of the operation by establishing and maintaining high standards of performance.

Priority: a cultural shift

Edison and Midwest leadership also realized that the company needed to take the following

actions to create a strong safety culture and reach its goals:

- Make safety at least as important as production and quality (good safety is good business).
- Gather greater input from stations and include it in the process for setting challenging goals and defining action plans.
- Expand the safety leadership organization by involving all levels of employees and management.
- Establish the corporate safety policy as the driving force behind systems and processes for managing safety.
- Ensure that all, not just some, potential workplace safety hazards are identified, analyzed and safe-guarded.
- Create a comprehensive, structured auditing system that involves all levels of the organization; collect data, and use this data as an agent of change.
- Eliminate the potential for hiding injuries by encouraging a culture where injury treatment and prevention take priority over financial incentives.
- Ensure that everyone on a station site, including contractors, is required to comply with a consistent set of safety policies and regulations.

The Midwest improvement strategy

Although leadership commitment and support were key drivers in building a safety culture, Midwest and the DuPont consulting team agreed that the greatest success would be achieved through implementing an improvement strategy that included seven essential steps:

1. Establish a strategic safety management structure.
2. Develop and introduce safety process systems in the areas of safety observation, incident investigation, rules and procedures, and communications, activities and involvement.
3. Develop performance standards and metrics to monitor safety performance.
4. Build safety leadership competencies at all levels of the organization.
5. Expand workplace safety systems to include contractors.
6. Establish process safety reviews to identify and mitigate risks from high-hazard operations.
7. Train employees and contractors on new safety systems and processes.

Achieving improvement through a comprehensive approach

Midwest, with support from DuPont, developed and implemented a safety management system focused around the operations environment. It provides the organizational, process and skill infrastructure needed to broaden the perspective of safety, incorporate accountabilities and move Midwest toward being an injury-free workplace. It was accomplished through a comprehensive three-year strategic process that included:

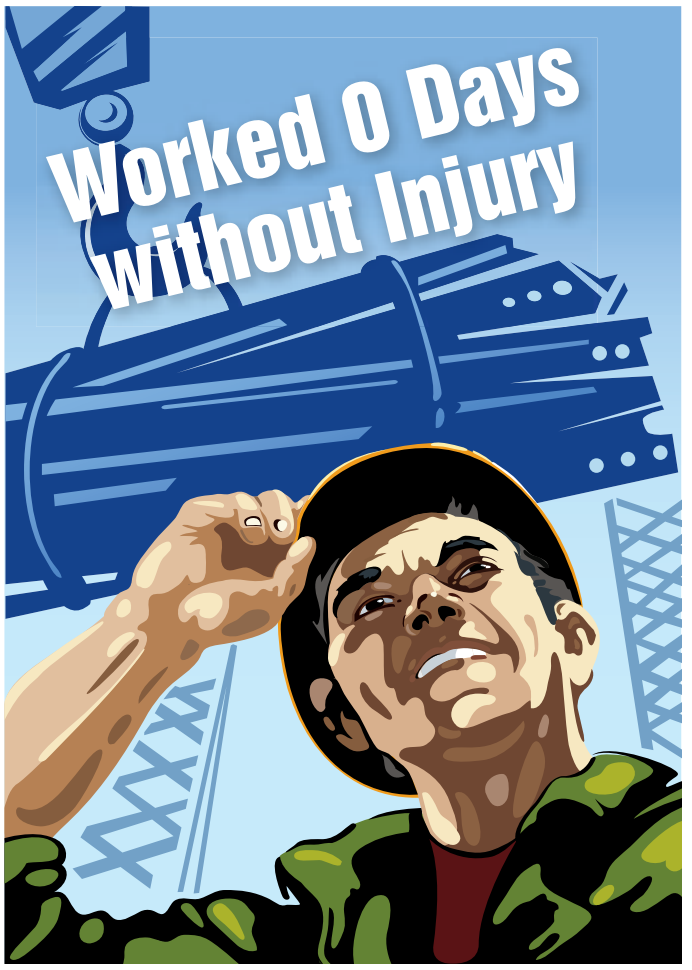
- Defining and documenting safe work standards.
- Reinforcing standards and expectations through auditing and observation.
- Fostering employee involvement through activities and communication.

- Preventing incident recurrence through incident investigation.
- Incorporating safety into contractor relationships.
- Driving accountability through actionable information.

The improvement strategy was organized by DuPont and implemented in three phases to drive positive organizational results. First, a division safety system was designed. DuPont and Midwest established a division-level safety governance structure and designed the future-state Midwest safety system and processes. These processes were piloted at individual sites prior to broader roll-out.

Second, a Central Safety Committee was initiated at each site, and sites prepared for the roll-out of the Midwest safety system and processes. Third, all levels of the organization participated in safety leadership training and development workshops, and a detailed re-assessment of the new system and processes were completed at each site, along with additional activities designed to drive cultural assimilation and optimization.

The work with Midwest has been expanded to now include Edison facilities in other parts of the country, so that processes and practices are consistent across all of Edison and its fleet of more than 40 coal, gas and wind generating facilities in 13 states.



Importance of process improvement and communication

DuPont helped Midwest manage the necessary internal changes through a proprietary process improvement framework, which includes assessing the current state, envisioning the future state, planning the transition, and implementing the change.

It was also critical to the success of the implementation to ensure continual two-way communication among all stakeholders involved in safety management at Midwest, including:

- Corporate safety committee
- Steering team
- Top leadership
- Team leads
- Process improvement teams
- Employees

Results

A key deliverable for the Midwest steering committee was to achieve at least a 60% reduction in injuries to Midwest employees against a 2006 year-end baseline. This would represent a major milestone on a path to zero injuries. By year-end 2010, Midwest reduced its incidence rate by 73%, DART rate by 68% and LWDC rate by 72%.

In addition to reducing injuries, the most important benefits of implementing a safety management structure at Edison and Midwest included the development of a work environment that fosters trust and openness, and invites collaboration between company management and its employee union. The process has also created professional development opportunities for employees in the areas of safety management, project management, team building, process methodology and leadership skills.

Since sustainability is a primary goal of every DuPont safety consulting engagement, an annual safety summit was created to help maintain and strengthen improvement across all of Edison. Each year, successes are celebrated at the summit and continuous improvement opportunities are identified. As a result, this event has helped anchor and reinforce safety sustainability throughout the company, and over time.

Conclusion

To maintain a world-class safety management structure and safety culture, an organization must establish high safety standards; regularly review its performance, monitor operations and processes; make needed improvements promptly; and continue safety training, coaching and other awareness-building activities so that all employees understand their responsibilities and know how to work safely. EB

For information on DuPont Sustainable Solutions and its safety management system consulting services, visit www.sustainablesolutions.dupont.com.

Standard Products 13.7W 6-in LED recessed downlight kit

Standard Products boasts its new 13.7-watt 6-in. LED recessed downlight kit delivers smooth, even light without any pixilation or glare, and serves as a direct replacement for 65W BR30 incandescents. The kit promises single-bin colour consistency for lamp-to-lamp colour reliability, and fits in many IC and non-IC recessed housings. Torsion springs allows for quick installation, and the driver is located on the exterior of the heat sink for better heat dissipation. Complete with thermal cutout at 90ºC to guard against overheating, the dimmable, Energy Star-qualified kit is certified to RoHS, FCC and cULus.
STANDARD PRODUCTS
www.standardpro.com

Sollos Landscape Lighting announces Deck/Post Lights

Sollos Landscape Lighting, a Halco Lighting Technologies company, has launched its Deck/Post Light, calling it the perfect fixture to enhance low-level area lighting for decks, patios, gazebos and other landscapes. The fixture operates both halogen lamps and LED lamps, and features a silicone o-ring between the fixture cover and housing to provide a watertight seal, it says.
SOLLOS LANDSCAPE LIGHTING
www.solloslighting.com

Beacon introduces Inspire LED outdoor luminaires

Beacon Products, a division of Hubbell Lighting, has unveiled its Inspire LED outdoor luminaires—a collection of new contemporary-design luminaires, which provide highly energy-conserving lighting, it says.

According to the company, all Inspire models provide broad, evenly distributed patterns of directional white light (unless amber LEDs are specified) yielding low or no glare. Additionally, the new full-colour, 132-page Inspire LED Collection catalogue is now available.
BEACON PRODUCTS
www.beaconproducts.com

Alumen8 8A SRL Series downlights

Alumen8 Division has introduced what it calls the lighting industry's first LED fixture that fits standard 2x2 recessed ceiling-grid downlights. According to Alumen8, the 8A SRL Series delivers very

low-watt, energy-conserving evenly distributed ambient interior illumination for a broad range of commercial, institutional environments; new installations or energy-saving retrofits. LED modules are available in 2700°K, 3500°K, 4000°K or 5000°K colour temperatures. The fixture is cUL and UL Damp listed.
ALUMEN8
www.alumen8a.com

RC Lighting introduces FXLED78 LED replacement

RC Lighting has expanded its LFlood line of floodlights to include the FXLED78, a 78W LED replacement for 250W metal halide floodlights. RC Lighting describes it as the first LED floodlight to offer the benefits of high wattage capabilities in an affordable price range, boasting that it delivers an unprecedented combination of light quality, long life, and affordability to a broad range of outdoor commercial LED lighting applications. The floodlight delivers over 5900 lumens of light, and delivers nearly 70% energy savings relative to standard 250W metal halide systems, it adds.
RC LIGHTING
www.rclighting.ca

Solais LED Lamps receive Energy Star certification

Solais Lighting has announced Energy Star certification for its LED lamps, including the: LR38 PAR38 replacement, LR38 PAR38 replacement, and LR30LN PAR30 Long-Neck replacement. All new Energy Star-certified Solais LED lamps feature Luxiance Thermal Management Technology, which utilizes a unique active cooling system to deliver superior light output and performance, adds Solais.
SOLAIS LIGHTING
www.solais.com

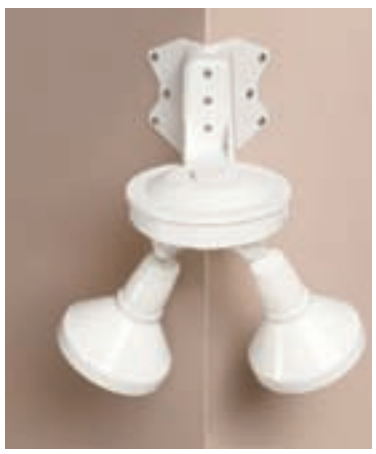
APS Resource E-Saver LED replacement lamps

APS Resource claims its new

E-Saver LED lamps save energy and money without sacrificing light output at the loading dock, as well as throughout the rest of the facility. Designed with LED optics, the lamp is available as a PAR38, 18W LED lamp or a PAR30, 15W LED lamp. According to the company, both lamps considerably reduce energy costs compared to traditional 150-watt incandescent bulbs; and both offer a 50,000-hour lamp life.
APS RESOURCE
www.apsresource.com

EB products

Arlington non-metallic corner-mount box 8161CB



Arlington Industries has introduced its non-metallic corner-mount box 8161CB which mounts security cameras, detectors or fixtures face down on an outside corner. The 8161CB model holds up to 50 lbs. The product is also available with a ground clip for Canadian orders.
ARLINGTON INDUSTRIES
www.aifittings.com

Ideal expands industrial line of screwdriver bits and accessories

Ideal Industries has expanded its line to include more than 60 new SKU's of industrial-grade screwdriver bits. The bits are constructed from S2M tool steel, and are manufactured to tight tolerances to ensure the most accurate fit and full fastener engagement, it says. Both insert and power type bits are available in standard size: Phillips, Slotted and Square designs. As part of the introduction, Ideal is also offering accessories such as the Quick Change Chuck, socket adapters, magnetic bit holders and magnetic nut setters.
IDEAL INDUSTRIES
www.idealindustries.com

Milwaukee M18 SDS Plus Rotary Hammer (2605-22 and -20)

Milwaukee claims its new M18 Cordless 7/8" SDS Plus Rotary Hammer delivers 0-1,400 RPM, 0-4,800 BPM and up to 40% more run-time and 2X longer life

than the competition. The tool features 3-Mode Operation and Variable Position Chisel Stop, while a mechanical clutch protects the motor when the bit binds and the Anti-Vibration System (AVS) delivers maximum user comfort by minimizing vibration, it adds. It also offers Digital Power Management (DPM) overload protection to help prevent damage to the tool and battery in abusive situations.
MILWAUKEE ELECTRIC TOOL
www.milwaukeetool.com

IPEX NEW PRODUCTS FROM IPEX ELECTRICAL SYSTEMS

Round Floor Box and Stand

Simple yet innovative, the new Round Floor Box Stand is designed to raise the Round Floor Box off the concrete form allowing the ENT or conduit to enter the Box in a flat and straight path. Installed together, the Floor Box and Stand accommodates the different rebar and post-tensioned cable heights and slab depths found from job-site to job-site.

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

SceptaCon™ PVC Conduit for HDD

If you're running electrical and telecommunication cable conduit under a busy road or highway, then you need SceptaCon™. SceptaCon™ links seamlessly to existing PVC conduit infrastructure and allows utilities to standardize on PVC throughout their entire electrical system. And because SceptaCon™ is made to the same high standards as our Scepter Rigid PVC Conduit, contractors and electrical utilities can be assured of the same level of quality – above ground and below.

Save Time & Money with Kwikon® Concrete Wall Boxes

Kwikon® Single Gang Concrete Wall Boxes offer a fully assembled, PVC alternative for installing boxes in poured-in-place concrete walls. Featuring a concrete-tight poly film covering the box opening and integral hubs, the Concrete Wall Box eliminates the time-consuming wrapping and taping work associated with traditional metal boxes.

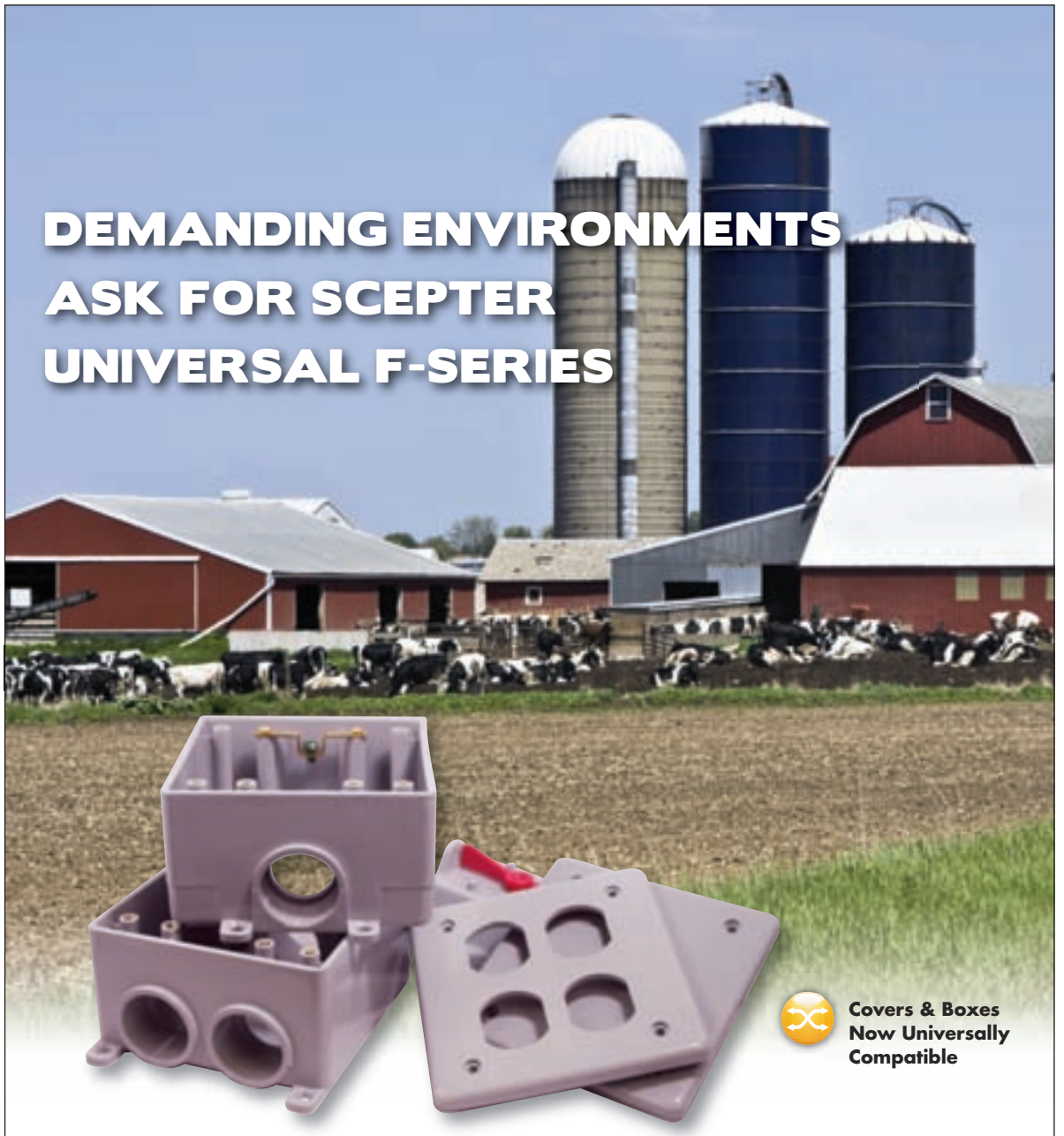
The non-metallic, non-conductive and non-corroding boxes arrive at the jobsite ready to install saving you time and money!

ENT Support for Concrete Slab Construction

Perfect for use in high-rise, post-tensioned buildings, the new ENT Support Unit (ESU) raises the tubing or conduit up off the concrete form to maintain a level raceway during the concrete pour. With its minimal surface contact, the ESU allows for maximum aggregate flow and concrete consolidation. Constructed with an easy locking mechanism for any 1/2" to 2" sized ENT, the ESU saves installation time and labour compared to using traditional tie wire. The plastic material also eliminates corrosion on exposed surfaces.

EPR Kit Adapters make Duct repairs quick and easy!

New Adapters for our EPR Conduit Repair Kits allow contractors to repair a broken section of DB-II duct while leaving the cables inside and restoring the duct to its original form. The pre-cut adapters easily open around existing cabling to make repairs quickly and effectively, reducing end-user downtime and complaints, and saving contractors time, labour and money.



Contractors know that only Scepter's Universal F-Series double gang boxes and covers have them covered even in the most demanding areas like wash-downs, high corrosion and chemical environments. Our new Universal design works with any industry standard double gang box or cover offering greater ease and flexibility on the jobsite.

Vist **ipexelectrical.com** to watch our new product video.

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

IPEX Scepter® Tough Products for Tough Environments®

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For more information call Cdn. Toll Free: 1-866-473-9462 or visit www.ipexelectrical.com

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New options for Dual-Lite LiteGear LG2SI inverter

New self-testing and self-diagnostic options are available in Dual-Lite's LiteGear emergency egress solution, allowing the LiteGear LG2SI compact inverter to automatically conduct its own testing and diagnose any potential issues—even before an actual emergency occurs, says Dual-Lite. The LG2SI (250 VA) unit performs a 1-min test every 28 days, and alternates between a 30-min and 60-min test every six months. It also features a load-learning capability that helps ensure every test of the emergency lighting load is consistent.
DUAL-LITE
www.dual-lite.com

Brady BMP53 Label Maker features network card for wireless printing

The new Brady BMP53 Label Maker features built-in Bluetooth technology for wireless printing and a portable printer which allows users to design and print labels wirelessly with smart phones. To print wirelessly,

customers download one of the free Brady mobile apps from the Android Marketplace onto their phones. The app will read what cartridge is installed in the BMP53 Label Maker and automatically generate the appropriate label template, along with customization options.
BRADY CANADA
www.bradycanada.ca

Britech Snow-Cable ice and snow melting system

Britech has introduced its Snow-Cable ice and snow melting system, designed specifically to be installed under concrete, asphalt or interlocking bricks. According to Britech, the system is ideal for large areas, such as driveways, stairways and irregularly shaped areas. Each cable features twin conductor heat resistant ¼" cable, with lengths ranging from 88 to 354 ft.
BRITECH
www.britech.ca

Burndy improves YG14BTC28 bus bar connector

Burndy, a manufacturer and provider of connector solutions, has introduced an enhancement to its existing line of type YG-B Hyground compression connectors suitable for attachment to busbar or steel. According to Burndy, the YG14BTC28 bus bar connector now accommodates a range of steel or busbar 1/8" to 1/4", with a wire range of 1/0 to 4/0, and can be installed with the Burndy U1105 die set and applicable installation tool, it adds.
BURNDY
www.burndy.com

Reelcraft introduces new tri-tap cord reels

Reelcraft has unveiled new tri-tap cord reels which can "supply enough power for up to three electrical implements where and when you need it", it says. The new accessory option is based on its current L4000 series reel platform. Models are available in 16/3 or 12/3 cord and either standard triple tap or GFCI protected triple tap.
REELCRAFT
www.reelcraft.com

2012 Canadian Electrical Code now available

The 2012 edition of the Canadian Electrical Code is now available - and it continues to provide guidance on safe electrical installations practices that can impact your business, says CSA Standards. The 22nd edition of the Code contains more than 180 updates and revisions to various sections, such as: emerging technology, renewable energy sources including solar & wind, new requirements for electric vehicle charging, and new cable types.
CSA STANDARDS
www.csa.ca

Russelectric 5-15kV circuit breaker-type switches

Russelectric has unveiled its new line of medium-voltage (5-15kV) circuit breaker-type automatic transfer switches and bypass/isolation switches. According to Russelectric, the switches transfer electrical loads between normal and emergency power sources through the carefully controlled opening and closing of circuit breakers and may be configured for open- or closed-transition transfer.
RUSSELECTRIC
www.russelectric.com

More products can be found online. Visit us at EBMag.com.

ADVERTISER INDEX

LES STOCH, P.Eng.

The new 2012 Canadian Electrical Code

I excitedly cracked open my shiny, new Canadian Electrical Code to see what the future might bring. I found it full of surprises: most of them good, some... not so much.

Section 4 - Conductors and Section 12 - Wiring Methods have received a lot of attention. The allowable wiring ampacities provided in Tables 1 to 4, as well as the correction factors contained in Tables 5A to 5D, have been revised upward to better harmonize with the National Electrical Code (NEC) in the U.S. You will find the allowable ampacities of many wire sizes have increased significantly, resulting in smaller wire sizes. If you own any copper or aluminum shares, sell them quickly!

Some first-class changes have come about:

- **Rule 10-814(2)** - Bonding Conductor Size now requires bonding conductors in parallel cables or conduit also be paralleled. This was previously permitted. But, as you know, the lowest impedance fault path is always closest to the circuit conductors that supply the fault.
- **Rule 32-208(1)** - Transfer Switches now clarifies that each fire pump must have its own transfer switch. This earlier requirement was not as clearly stated in earlier versions.
- **Rule 46-204** - Protection of Electrical Conductors requires emergency power supply conductors and associated communication conductors be protected against fire exposure. This requirement is similar to the present requirement for fire pump wiring.
- **Rule 18-154** - Sealing Class I, Zone 2 simplifies the requirement for cable seals for non-explosionproof equipment in hazardous locations.

There are also some notable new rules:

- **Rule 18-052** - Marking provides some new IEC designations for Class I hazardous location equipment, protection levels Ga, Gb and Gc.
- **Rule 4-006(1)** - Temperature Limitations now requires that, where electrical equipment maximum termination temperatures are marked, the maximum allowable ampacities of conductors must be based on the corresponding temperature columns from Tables 1 to 4.
- **There is a brand new Section 64** - Renewable Energy Systems.
- **There is also a new Table 12E** - Allowable Ampacities for Type DLO cables in a Permanent Installation. The new table applies to portable power cables.

As usual, there are a few head scratchers:

- **The disparity of Rule 14-100(d)** - Overcurrent Protection of Conductors with the remainder of the Rule has not been addressed.
- **Rule 10-212(1)** - Grounding Conductors for Equipment in an Ungrounded System says there must be no connection between the grounding conductor and the system neutral. That seems to overstate the point... it should be obvious.
- **Rule 32-102(1)** - Wiring Methods no longer requires concrete encasement for fire alarm system wiring in non-metallic conduit/tubing. This move is in the wrong direction.
- **Rule 46-108(2)(c)** - Wiring Methods now permits emergency power supply conductors in rigid non-metallic conduit without concrete encasement. The requirement still stands for non-metallic tubing. Granted, new Rule 46-204 and Appendix B do require a 1-hr fire rating for emergency power wiring, but the change is bound to cause some initial confusion.
- **Rule 14-104(2)** seems to provide exceptions to the easements provided by Table 13 for wire sizes #14 to #10 AWG. However, Table 13 references the rule without any qualifications, and the table does not appear to acknowledge the changes.
- **Rule 4-004(21)** addresses allowable ampacities for bare or covered conductors with reference to a new Table 66. However, it is only when we turn to Table 66 that it becomes obvious the table only applies to overhead wiring.

I'm sure you will derive much enjoyment finding your way through the new book. EB

Les Stoch is president of L. Stoch & Associates, specialists in quality management/engineering services. He is a member of PEO, OEL and IAEI, and develops and delivers electrical code and technical workshops for Dalhousie University. He also developed the Master Electrician training program and exam (Ontario) for the Electrical Contractor Registration Agency. Visit L. Stoch & Associates online at www.lstoch.ca.

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Tackle The Code Conundrum... if you dare

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

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

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

QUESTION 1

For single dwelling units, the CEC requires minimum ___ duplex receptacle(s) to be installed in a two-car garage with a cord-connected central vacuum and a garbage disposal unit installed.

a) one **b)** two
c) three **d)** four

QUESTION 2

The maximum rating for overcurrent protection for exposed wiring permanent outdoor lighting is:

a) 15 A **b)** 20 A
c) 30 A **d)** 40 A

QUESTION 3

A Class I location is:

a) an area that has flammable vapours
b) an area that has combustible dusts
c) an area that has ignitable flyings
d) none of the above

Answers to Code Conundrum EBMag January 2012

Q-1: In dwelling units, the CEC requires no point along the floor line of any usable wall space to be more than ___ horizontally from a receptacle in that space.

c) 1.8 m. Rule 26-712(a).

Q-2: The minimum size conduit required to contain 6 #6AWG T90 Nylon, 12 #14AWG TWU75 and 7 #12AWG TW75 is:

b) 41 mm. Rule 12-1014.

Q-3: The maximum allowable ampacity for #6AWG T90 Nylon run in a conduit containing 6 #6AWG T90 Nylon, 12 #14AWG TWU75 and 7 #12AWG TW75 is:

d) 33A. Rule 4-004(11) & (12).

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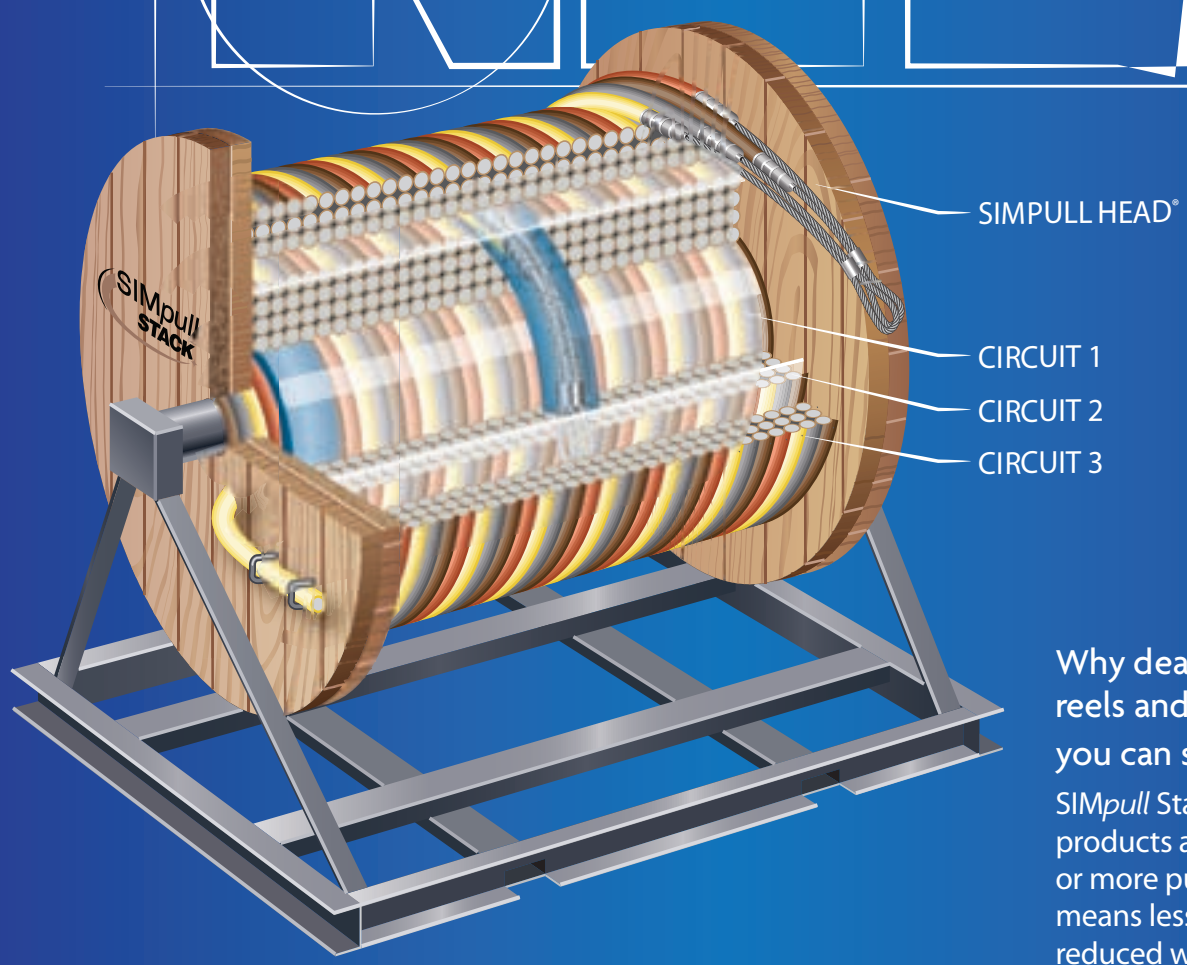

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