

AN ANNEX PUBLISHING & PRINTING INC. PUBLICATION • VOLUME 47 • ISSUE 7

Electrical Business

AUGUST 2011



revolution

is on page 5.

Wind turbines, farm operations and stray voltage... cause for concern?

■ Also in this issue...

- Canada's first all-LED parking building
- Convection space heating
- Seismic certification

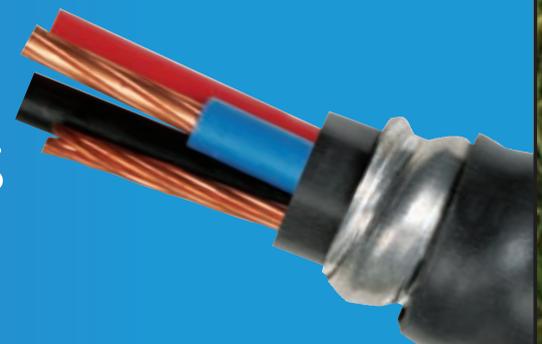
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LEDs continue to be all the rage...it is also the one lighting technology that creates the most confusion.

The present and future of lighting

Those of you who follow my exploits will know I've returned from what was perhaps one of my busiest travel seasons yet, with Electro-Federation Canada's annual conference in Quebec City, MCEE in Montreal, IED's annual AGM in Windsor, the Electricity Sector Council's Bright Futures conference in Toronto, Ontario Electrical League's annual gathering in Guelph, Nedco's Electrifest in Mississauga, and so on.

Now the summer is upon us: time for rest, and time for family. Until the fall, that is.

Meantime, I wanted to tell you about my visit to Lightfair 2011, the leading lighting event in North America, and some of the things I saw.

As you can imagine, LEDs continue to be all the rage; sadly, in my discussions with you, it is also the one lighting technology that creates the most confusion. (I happily direct you to an article by Lutron in this issue that gets into some excellent nitty-gritty about LED bulbs and fixtures, drivers and controls.) Perhaps the most interesting "new" thing I learned about LEDs is some manufacturers are now creating LED modules that screw in and out of fixtures; meaning that when an LED module finally expires, there's no need to replace the whole fixture—simply swap out the module for a new one.

Some manufacturers are also "future-proofing" their fixtures by standardizing module interconnects. In this case, as LED modules become more powerful, you simply swap out older technology for the new. (I encourage you to visit our Video Gallery at EBMag.com to check out some of our Lightfair booth visits to learn more—not just about LEDs, but other lighting advancements.)

Meantime, I had the opportunity to meet and chat with Maryrose Sylvester, the new president and CEO of GE Lighting, and Jamie Irick, the president and CEO of GE Lighting's LED business. This was an excellent opportunity to ask them whatever happened to the high-efficiency incandescent bulb they were supposedly bringing to market several years ago, then decided not to... without really telling anyone. (See "Pity the poor incandescent", EBMag April 2007, pg 25.)

So I asked Mr. Irick, "Are you the guy who killed the HEI?", and he chuckled and said "No", adding that—when all was said and done—the HEI would still fall short of the energy efficiency requirements being considered by legislators.

And Acuity Brands has an interesting take on lighting... all lighting. Acuity has been buying up companies like MechoShade (mechanical window shades) and Sunoptics ("prismatic" skylights) because, as executive VP and CFO Richard Reece explains, lighting a space should also include natural light, or daylighting, not strictly artificial.

Lighting controls are also a big thing and getting bigger, especially the ones that operate wirelessly, making them ideal for new construction but especially for retrofit applications.

With so much change and so many advancements in this industry, it's easy to see how confusing, yet altogether exciting, lighting can be. **EB**

Anthony Caplan



On the cover and page 28

Wind turbines, farm operations and stray voltage... cause for concern?

Stray or 'tingle' voltage is unwanted electricity that often results from an improperly grounded or ungrounded electrical distribution system.

Most commonly found at agricultural operations, this can pose a safety risk to animals that come into contact with it.

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Electric space heating products have not seen any major advances in years but given the push towards green energy solutions, the need for performance and package improvements has never been more apparent.

14 Learn to select, then dim, LEDs in general illumination applications

Today, LEDs are the new hot item on the shelves, but while everyone wants to use them, often times designers don't know how to control them. Here is a brief overview that covers all the basics for LEDs and dimming LEDs.

21 Security options for coping with copper theft

Since metal prices began their ascent on world markets, thefts of the lucrative wire and cable have proven difficult to stop at the source—how can you protect yourself?

26 Calgary Airport Authority builds Canada's first all-LED parking building

The Calgary Airport Authority (CAA) is a not-for-profit, non-share capital corporation responsible for the management, maintenance and development

of Calgary International Airport (YYC). It's also the first all-LED parking building in the country.

32 IP video surveillance and wireless networks: A successful partnership

A benefit of IP video surveillance technology is that digital video is compressed and streamed across standard ethernet networks using the internet protocol (IP). Today, there are a number of wireless technologies that allow digital surveillance video to be easily transmitted across large urban areas and from remote locations.

35 Motor and drive system resonance problems and solutions

Mechanical resonance occurs when an external source amplifies the vibration level of a mass or structure at its natural frequency. Here are some solutions.

37 Seismic certification and preapproval of emergency power generation equipment

Read why we Canadians should care about the State of California's Facilities Development Division (FDD), which certifies that buildings, critical life-safety equipment and emergency standby power systems meet earthquake survivability standards.

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Siemens Canada launches Sinvert solar inverter manufacturing



Visit our photo gallery at <http://bit.ly/j2Z0kA> to see more photos of the event and the plant facility tour.

EBMag was there in June when Siemens Canada's Industry Automation division celebrated the launch of the Sinvert solar inverter at its Ontario production facility for the Canadian solar photovoltaic (PV) market.

Manufactured at the company's Burlington plant, manufacturing the PV inverters locally allows Siemens' customers investing in commercial and large ground mount applications to meet the "minimum required domestic content level" set by the Ontario government's feed-in-tariff (FIT) program.

"In addition to job creation, our commitment to manufacture inverters locally is another example of how Siemens is helping to create clean energy that is linked to a sustainable future," said Joris Myny, vice president, Industry Automation and Drive Technologies, Siemens Canada.

"The first inverters to come off the production line have been shipped to solar farms in Ontario," added Anthony Bezina, plant manager at the Siemens Burlington facility. "Our two decades of experience in local drives manufacturing enabled us to ramp up production successfully over the last months."

The technology that Siemens is providing takes DC power as input generated from PV-Modules and converts it into AC power, which is then relayed into the grid. According to Siemens, these inverters will enable solar projects in Ontario with an annual output of approximately 250MW, or enough to power around 32,000 homes.

Siemens has invested more than \$3 million (CAD) in design, test equipment and upgrades to the facility to accommodate the inverter production line, it said. As well, there are currently 10 employees directly involved in the solar PV inverter production at the facility, with another 50 skilled job positions in business development, engineering and production to support its PV business in Canada, it added.

"Ontario's Long-Term Energy Plan is an economic plan which is building our clean energy economy, creating thousands of jobs and attracting billions of dollars of investment for Ontarians," said Brad Duguid, Ontario's minister of Energy. "Thank you to Siemens for being a part of this rapidly growing clean energy industry."

Product Recall - GE recalls Zoneline AC and Heaters

General Electric has voluntarily recalled its Zoneline Air Conditioners and Heaters, due to a possible fire hazard caused by an electrical component in the heating system that can fail. Approximately 3600 units were sold in Canada from April 1, 2010 through April 30, 2011. The products are manufactured by Sharp Corporation of Japan, and distributed by Gordon R. Williams Corporation ("Williams").

In Canada, GE has received one report involving smoke and/or fire with the affected products. There have also been three reported incidents in the U.S.. In two of the reported incidents, fire extended beyond the unit resulting in property damage. No injuries have been reported.

Product description: GE Packaged Terminal Air Conditioners and packaged terminal heat pumps ("PTACs") manufactured between approximately January 2010 and March 2011. Affected serial and model numbers include model no. AZ41 and AZ61, and serial no.: AT, DT, FT, GT, HT, LT, MT, RT, ST, TT, VT, ZT, AV, DV and FV.

For additional information, contact Williams toll-free at 1 (888) 209-0999 between 8 a.m. and 5 p.m. ET Monday through Friday, or visit the firm's website at www.williamshvac.com. Consumers may also contact the firm by e-mail sent to zonelinerecall@williamshvac.com.

Product Recall - Milestone AV Technologies recalls Sanus Elements ELM-205

Milestone AV Technologies LLC has announced a voluntary recall of its Sanus Elements model ELM-205 Low-Profile Power Conditioner, as improper grounding of the case and inadequate insulation for the circuit breaker could pose an electrical shock hazard to consumers. This recall involves all Sanus Elements ELM205 products made prior to December 2010 (Date codes: C1806090, C1805100).

The products are manufactured by Rite-Tech Industrial Co., Ltd., of Taiwan, and imported by Milestone AV Technologies LLC.

Approximately 200 units have been sold to Canadian resellers/consumers between June 2009 through December 2010.

Consumers should immediately stop using the product and contact Milestone for a replacement product or refund. For additional information, contact Milestone toll-free at (877) 894-6280 between 8 a.m. and 9 p.m. CT Monday through Friday and between 10:30 a.m. and 7 p.m. CT Saturday and Sunday, or visit the firm's website at www.milestone.com/recall.

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

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Published by Annex Publishing & Printing Inc.
240 Edward Street, Aurora, ON L4G 3S9
Phone: (905) 727-0077 • Fax: (905) 727-0017

PUBLICATION MAIL AGREEMENT #40065710
RETURN UNDELIVERABLE CANADIAN ADDRESSES
TO CIRCULATION DEPT.
240 EDWARD STREET, AURORA, ON L4G 3S9
e-mail - dkoivisto@annexweb.com

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

Printed in Canada
ISSN 0013-4244

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

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





Canadian Eric German wins grand prize in Planet Extech's "Switch Story" contest

Planet Extech, the social networking web site for users and fans of Extech Instruments (www.extech.com), has announced that Eric German of Ontario is one of two grand prize winners of its "Switch Story" contest, and will receive an Apple iPad.

German uses several Extech meters and testers along with a Flir i7 thermal imaging camera for wind turbine maintenance. In his switch story, he explained how Extech plays a "key role" in the upkeep of green energy infrastructure: "We are now using several products successfully to maintain millions of dollars worth of wind power generation equipment!" He also uses Extech and Flir for performing building, equipment, and electrical system inspections in his own business, and commended on Extech's durability: "after some serious use, all my gear is still performing and more importantly, still accurate and reliable."

Arpineh Mullaney, vice president for Extech Instruments, announced the winners on Planet Extech. "Everyday at Extech, we're hearing from customers who are stepping forward to share their stories of why they switched to Extech. Our customers' stories, told in their own words, resonate with test equipment users who now face a dizzying array of brands and products," he said.

The Switch Story Contest is still on. Extech customers can share their switch story by visiting www.extech.com/switch2ex-tech. All entrants will receive a 2-LED camo cap – a \$20 USD value. Two winning entries will be selected to receive Apple iPad grand prizes in December 2011.

EFC and NAED go Head-To-Head in inaugural Waterman Cup

Electro-Federation Canada (EFC, www.electrofed.com) and the National Association of Electrical Distributors (NAED, www.naed.org) will face off this month in a "friendly" game of golf to capture the 1st Annual Waterman Cup!

EFC and NAED will each submit four golfers to represent Team Canada and Team USA, respectively. The Waterman Cup will be hosted during EFC's Federation Cup Tournament August 22 at Rattlesnake Point Golf Club in Milton, Ont. EFC's Golf chair, Brian Power, and the golf committee are excited about the newly created Waterman Cup challenge; more importantly, they say the industry networking among North American peers will prove invaluable.

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Thomas & Betts

Weg and MTOI establish joint venture to produce wind turbines

Weg and MTOI (M.Torres Ólvega Industrial S.L.) have teamed up to manufacture, assemble, install and commercialize wind turbines, as well as a package of operation and maintenance services to be provided in Brazil.

The technology developed by MTOI allows the power generator to be coupled directly to the turbine shaft, without requiring the

application of a gearbox, it said. As a result, there will be a "significant reduction" of components, operational and maintenance costs, it added.

"We are stepping into this segment with a technology that is modern and comparable to what is best in the market. Our partner has already supplied wind turbines to Europe for over 10 years," said Newton Idemori, Weg Business Development Director (www.weg.net/ca).



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The companies are also given equal shareholding participation.

The MTOI Group (www.mtoi.es/en) was founded in 1975 to design, develop and manufacture systems for industrial and process automation solutions for the aeronautics, pulp & paper and energy sectors.

The wind turbines will be initially manufactured at Weg Energy manufacturing facilities in Brazil with the first order scheduled to be delivered later this year. It is expected to have 250 employees working directly in manufacturing of this new Weg product.

"In addition to allowing a more direct participation in the wind power generation business, this cooperation agreement will give us the possibility of meeting the growing domestic market demand," said Weg CEO Harry Schmelzer Jr. "Furthermore, several of our current products such as generators, transformers, drives, electric motors and coatings will make part of the package to be supplied to this market segment."

Canada funds two hydroelectric dams in Quebec

Jean-Pierre Blackburn, minister of veterans affairs and MP for Jonquiere-Alma, announced funding for two hydroelectric dams in the City of Saguenay, Que. The ecoEnergy for Renewable Power program is expected to provide about \$6.9 million over 10 years to the city for the two dams: Centrale Chute-Garneau and Centrale Pont-Arnaud.

"Investing in clean energy technologies stimulates the growth of a domestic clean energy industry, creating high-quality jobs for Canadians," said Blackburn.

The Pont-Arnaud and Chute-Garneau projects have a combined capacity of more than 13MW and are capable of generating enough electricity to power more than 7000 homes. The electricity produced will be sold to Hydro-Quebec.

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It is with sadness that we report the passing of **Peter Hochstein**, founder of **Relume Technologies**, who passed away over the Memorial Day weekend at his Troy, Mich. home at the age of 65. "We are extremely sad to lose Peter Hochstein. Besides being a dear friend and a great colleague, Peter was one of the grand men in our field," said Crawford Lipsey, company CEO. Peter has more than 80 patents to his credit, with 12 patents relating to LED thermal management and related technologies and four additional patents pending. As expressions of sympathy, contributions in Peter's name can be made to the South Oakland Shelter, 431 N Main Street, Royal Oak, Michigan 48067.



Mark McCafferty

Standard Products (www.standardpro.com) welcomes four additions to its sales team. New to the Alberta team is **Mark McCafferty**, who has a journeyman's electrical ticket combined with more than 20 years in sales and marketing. As a Lighting Specialist, McCafferty is responsible for business development in the Northern Alberta area. He can be reached at 780-231-8326. **Kevin Kuula** has joined the Ontario team, bringing with him 4+ years of sales and project/quotation experience with an electrical distributor. He can be contacted at 705-918-4494. The Quebec side has two new representatives. **Luc Chamberland** brings experience from the printing industry, totaling 32 years of direct business development. Serving as a Lighting Specialist for the South-Shore of Montreal, he will work with local



Kevin Kuula



Luc Chamberland



Oren Schwartz

distributors and develop new business opportunities with installers and end-users. He can be reached at 514-247-7224. **Oren Schwartz** brings 6 years experience in sales having worked as a consultant for companies needing help in rebuilding their sales teams, said the company. He is responsible for the business development in the Ottawa and Kingston areas, and can be contacted at 613-296-9986.



Jeff Kellermann

Ideal Industries Inc. (www.idealindustries.com) has named **Jeff Kellermann** vice president/general manager of its Tool Group. In this role, Kellermann will be responsible for all aspects of the operation of the company's retail and industrial sales groups, as well as its SK Hand Tool and Western Forge business units, said the company. He will report directly to Ideal president and CEO Jim James.

Thomas & Betts Canada (www.tnb.ca) underwent several organizational changes. **David Tracey** was named director, Market Development, Industrial and **André Boudreau** was appointed director, Market Development, Commercial. In these newly created positions, they will be responsible for the global planning and coordination of initiatives aimed at providing direction, market and sales strategies and support for end-user markets. **Brian Murphy** will take over from Tracey as regional sales manager, Atlantic Region. **Pascale Daviau** is named vice president, Marketing, and will lead the marketing and product management teams to ensure strategy execution, improved focus on innovation and close collaboration with the sales organization to support key market

growth initiatives, said the company. **Alain Quintal** was named vice president, Manufacturing and R&D, where in addition to his current responsibilities, he will assume leadership for all aspects of product development and R&D. **Brian Welling** was appointed director, E-Business & Information Technology. "He will use his extensive knowledge of the customer experience and T&B systems in this new role where he will be responsible for the development and deployment of T&B's E-Business strategy and tools," said the company. **Pierre David** will serve as vice president, Customer Service & Distribution, and will assume responsibility for all customer service activities. He will continue to be responsible for operations at the Bromont Distribution Center.



Jeff Harris

Magic Lite welcomes Jeff Harris as senior VP of Business Development **Magic Lite** (www.magiclite.com) has appointed **Jeff Harris** to the position of senior vice president, Business Development, who brings more than 28 years of experience in the commercial lighting field to the company. His experience in the electrical distribution field with Gerrie Electric encompasses aspects of commercial lighting and distribution including branch management, leading up to the position of marketing manager, said Magic Lite. His role here will be to build national distribution business by working with the national sales force and on building new streams of revenue through targeted marketing programs.

Bill Wylie, formerly manager, Business Market Program with Ontario Power Authority (OPA) has joined **PowerStream** (www.powerstream.ca) as a CDM (conservation & demand management) commercial program consultant.

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Stanley and Dewalt partner with Skills Canada for legacy tool program

Stanley Hand Tools (www.stanleyhandtools.ca) and Dewalt Power Tools & Accessories (www.dewalt.com), the official sponsors of the 2011 Canadian Skills Competition, have now begun a five-year partnership with Skills Canada (www.skillscanada.com), which includes a new legacy tool program where the companies will donate the hand and power tools and accessories used throughout the National Competitions to local schools in the city hosting the event.

This year's competition ran from June 1-4 in Quebec City (the team from EBMag was there!), and will see schools in the Quebec area receive a package of tools valued more than \$75,000.

"It is a great honour to be part of the 2011 National Competition and to partner with the Skills Canada organization," said Jocelyn Stephen, brand manager for Stanley & Dewalt. "With so many talented and future skilled trade students in attendance, we are happy to



be providing them with quality hand and power tools as part of the Competition from Stanley and Dewalt."

The national competition featured 500 secondary and post-secondary competitors from all 13 provinces and territories, competing for national titles in everything from welding to carpentry, robotics to hairstyling and auto service to cooking. Stanley Hand Tools and Dewalt Power Tools & Accessories provided different products to be used in the construction and manufacturing sector competitions.

"It is because of sponsors like Stanley and Dewalt that we are able to continue to encourage and support a coordinated Canadian approach to promoting skilled trades and technologies to youth," said Shaun Thorson, CEO of Skills. "With industry partners like Stanley and Dewalt, we can continue to help inspire and encourage youth to pursue professions in skilled trades and technology while ensuring industry has the pipeline of skilled labour force that they need for the future."

Canadian Council of Directors of Apprenticeship launches Red Seal Award of Excellence

The Canadian Council of Directors of Apprenticeship (CCDA) is doing something different this year by launching the Red Seal Award of Excellence: a biennial award to honour the contributions of provincial/territorial/federal apprenticeship and trade certification staff to the Interprovincial Standards Red Seal Program. The first recipient will be honoured in Ottawa at the CCDA Fall Meeting to be held in October 2011. The nomination period is now closed.

The award will be presented every second year to a staff member who has demonstrated inspirational leadership in the promotion and development of standards for apprenticeship training and trade certification.

Award recipients will have made an outstanding contribution to the promotion and development of apprenticeship and trade certification for Red Seal trades on the pan-Canadian or provincial/territorial level. The recipient will have distinguished himself or herself during their career through

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- Served as a role model for success
- Demonstrated qualities of outstanding leadership

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CEA names 2010 Sustainable Electricity Award winners

Horizon Utilities Corporation has won the Sustainability Company of the Year Award for 2010 for its overall leadership and innovation with respect to all three pillars of sustainable development, said the Canadian Electricity Association (CEA), (www.electricity.ca).

Horizon is among four companies receiving recognition by CEA during Canadian Environment Week. Now being presented for the second time, the annual Sustainable Electricity Program Awards recognize performance in: sustainability company of the year, environmental commitment, social responsibility, and economic excellence. Award recipients were evaluated and selected by an independent panel.

“Building on the CEA sustainability program, Horizon Utilities has shown tremendous leadership in integrating sustainable development to its daily activities and operations,” said Mike Harcourt, Chair of the Sustainable Electricity Program Public Advisory Panel, adding that Horizon delivers among the lowest operating costs and rates for residential and commercial customers in Ontario.

The other Sustainable Electricity Award winners are:

- **Newfoundland and Labrador Hydro (Nalcor): 2010 Environmental Commitment Award** for its “unique and innovative” Wind-Hydrogen-Diesel (WHD) Project. Developed in partnership with Memorial University and the University of New Brunswick, the system supplements diesel requirements with wind and hydrogen technology

to help reduce the environmental footprint of electricity generation in isolated communities.

- **Hydro One Inc.: 2010 Social Responsibility Award** for Hydro One’s stakeholder engagement strategy. A consultation process that included greater involvement in community events, consultations, and technical working groups enhanced Hydro One’s internal decision-making process and increased transparency with customers.

- **BC Hydro: 2010 Economic Excellence Award** for the utility’s Powering the Greenest Games initiative in support of the 2010 Olympic and Paralympic Games. BC Hydro designed the cleanest, most reliable, and most affordable power supply to the Games to date, according to CEA.

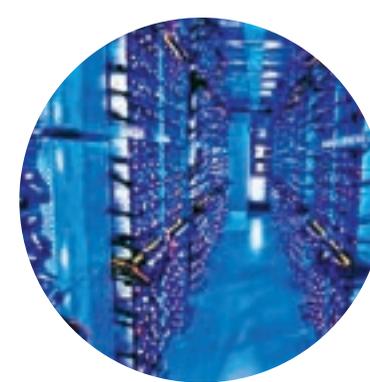
“These four winning companies showed extraordinary initiative and leadership in going beyond the status quo, and that is a must-have for promoting innovation and sustainable

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development in the electricity sector,” said Will Bridge, chief technology officer at TransAlta Corporation and executive chair of the CEA Sustainable Electricity program.

BluEarth closes acquisition of operating hydroelectric plants

BluEarth Renewables Inc., an independent renewable power producer, has closed its acquisition of an interest in ACH Limited Partnership. ACH

owns eight operating hydroelectric plants with 131 MW of capacity in Ontario. ACH was previously owned by AbitibiBowater and the Caisse de depot et placement du Quebec.

BluEarth (www.blueearthrenewables.com) and an unnamed Canadian institutional investor partnered on the \$640-million acquisition, where the plants have approximately 19 years remaining in a 20-year power purchase agreement with the Ontario Power Authority. The plants are expected to generate

long-term stable cash flows, said BluEarth.

“As part of our growth strategy, we wanted to acquire operating assets out of the gate to generate near term cash flow to internally finance the development of our business,” said Kent Brown, president and CEO. “Our primary focus now shifts to the acquisition of development projects, where our experienced team and financial strength have a unique ability to advance projects that may be stuck lacking capital or experience.”

Bosch prepares to celebrate 125-year anniversary

The Bosch Group is celebrating two major milestones this year—its 125th anniversary, as well as the 150th anniversary of its founder’s birth. On Nov. 15, 1886, Robert Bosch established his “Workshop for Precision Mechanics and Electrical Engineering” in Stuttgart, Germany, laying the foundation for what has become a global supplier of technology and services.

According to Bosch (www.bosch.us), the company operates through more than 300 subsidiaries and regional companies in more than 60 countries with a workforce of some 285,000 associates. Today, it employs more than 22,000 associates in more than 100 locations throughout Canada, the U.S. and Mexico.

“Bosch’s 125 years of success have been driven by innovative solutions that enhance the quality of life, the dedication of our associates and the partnerships with our customers,” said Peter Marks, chairman, president and CEO, Robert Bosch LLC and member of the Bosch board of management.

He continued: “100 years ago, the company generated more sales in the U.S. than in Europe. Today, we continue to build upon the legacy of globalization inspired by the entrepreneurial vision of our founder.”

Later this summer, Bosch associates will celebrate the milestone with several Experience Days. More than 20 regional events will take place throughout North America, including celebrations hosted Ontario, among other locations. These events combined will host more than half the cumulative total of North American Bosch associates, where associates’ contribution to the company’s success will be recognized among families and communities, explained Bosch. **EB**



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Dave Smith |

mind your safety **EB**

Entering outdoor substations Part three

(At the end of Part 2 in June/July 2011, Dave explained the dangers of electrostatic and electromagnetic induction, retracing your steps and staying away from equipment and lines.)

When you're in a substation, shorten your stride because of a phenomenon known as *ground potential rise*: defined by Ohm's law, current through resistance creates voltage drop. When a substation clears a fault to ground, and the current flows through the resistance of ground, you will have a voltage gradient on the ground from the centre of the station outward. We refer to this as ground potential rise.

It is there for the duration of the event, which could be seconds. This phenomenon makes it incredibly dangerous to do something as simple as plugging into an electrical outlet within a substation, then carrying the cord outside to conduct work. During a fault event, the ground potential difference will follow the extension cord outside the substation, and a worker at the end of that extension cord could be electrocuted.

Numerous problems have arisen over the years with telephone and other communications lines connected into substations that have had fault energy transmitted down their lines during lightning and other fault events.

The reason you don't want to walk directly under any lines is due to unknown flash protection boundaries. After completing an arc flash study for a client, we discovered high IE in their 138-kV substation. Where the primary lines drop down to the transformer, there is a distance of 12 ft to the ground. Our study showed that the Cat 4 FPB (flash protection boundary) from these lines extended 8 ft, meaning that any person walking underneath those lines, past the transformer, was within the FPB. People had been walking there for years but, now, that common path had to be barricaded.

Do not walk quickly through a substation, and always know where you are; know what the equipment is, where it is, and where it is going. Continuously use your visual senses. Watch for leaks on the ground; transformers and oil circuit breakers will generally ooze leaks around the valves but drips to ground are significant. Constantly sniff for anything abnormal (burning, ozone... anything that is not *normal* air). Watch for distortion of panels and equipment, heat damage on metal and evidence of soot, and always listen.

When other workers have safety grounds installed, stay away from them—they are part of the protective system, and you don't want to accidentally disturb them. During a fault, they whip like electrical snakes doing tremendous damage to anything close to them and, should one let go, the end swinging out will come out with hundreds of horsepower of force.

When you are responsible for substation inspections, you can get tremendous mileage from a set of binoculars. Most outdoor substation inspections are conducted during the day. It is wise to occasionally conduct one at night; a set of binoculars will help you identify small discharges that will lead you to a fault of which you had been previously unaware. For the most part, infrared and corona cameras, and partial discharge measurement will find problems your eyes will never be able to see. At the same time, never discount the quality of value of a set of trained and experienced eyes.

Recognize that a well-maintained substation is a controlled system of incredible force that becomes violent when control is lost. Entering a substation on a dry, warm, summer day far away from any buildings or habitation is different than walking into a substation after a storm, or in the winter time, or close to an area with a lot of contamination. (In one of our major cities, when a new highway overpass was built close to a substation, the maintenance frequency quadrupled for insulator cleaning due to road salt in an already humid area.)

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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Advances in convection space heating

Kelly Stinson

Electric space heating products have not seen any major advances in years. In most cases, electric heaters are treated as commodities; the only point for comparison being price. Given the push towards green energy solutions, the need for performance and package improvements in this relatively stagnant category has never been more apparent.

Before we look at where electric heat is going, it's important to familiarize ourselves with the current categories of electric heaters.

Types of electric heaters

Radiant heaters use infrared light to transmit the heat from the appliance directly to the occupant and other objects in the room. The amount of energy that can be transmitted is heavily dependent on the temperature of the heater. For a significant amount of radiant energy to be transmitted, the heater must be hot enough to glow red or even white. Much like a heat lamp in a fast food restaurant, objects must be directly in front of the radiant heater to be heated.

This type of heater is ideal for keeping warm in a cold space, like a garage or workshop. It will transfer heat to the objects or people in front of the heater without significantly heating the air in the garage or workshop. Use of a radiant heater outdoors is possible, as it will not work to heat the air, only the objects in front of it.

Forced and natural convection are similar in that they transfer heat to the ambient air; that air then carries the heat to the user and the rest of the room. As the name suggests, forced convectors use a fan to push air over the heating element and into the room, whereas natural convectors use the natural buoyancy of warm air to heat a room with no moving parts.

Forced convection will typically move air at high velocities and force the air movement in the room to circulate in an unnatural way. A fan will interrupt the natural airflow in a room and replace it with an artificial airflow. When the room has reached the set temperature, the fan will turn off and the natural airflow conditions of the room will resume. This change in airflow can lead to a perception of less comfort as the airflow in the room is constantly changing—warm one minute and cold the next. In addition, fans make noise—not a lot of noise but, when a fan turns on or off, the change in noise level in any room is noticeable and distracting.

The seemingly timeless electric baseboard has remained more or less unchanged for decades. Panel convection heaters are a more recent attempt to condense long baseboard heaters into a smaller space while maintaining all the quiet comfort of natural convection heat. The result is a narrower heater that fits more easily into a room's available space; however, the panel convector is installed higher up the wall and can be an unwelcome part of the décor.

A baseboard convector creates a wide, slow



moving air curtain that travels up the wall and slowly spreads out across the room. A panel convector creates a much faster airflow over a smaller area. This airflow is able to deliver the heat energy to the centre of a heated space much faster than the slower airflow from a baseboard convector. The delivery time of the heat to the centre of the room is critical for the overall comfort of the occupants. This is especially true when the room undergoes a change in condition, such as a door opening, a change to the set point of the thermostat, or even a drafty room. The faster the heater responds to change, the more comfortable the occupants.

Baseboard heaters are generally less expensive than panel convectors, and the debate of whether the benefits of a panel convector are warranted by the cost are ongoing. While baseboard heaters dominate the marketplace for this reason, their size sometimes limits where they can be installed.

Each type of convector has disadvantages that won't allow it to be used in all applications. The consumer market would surely be attracted to a product that combines the advantages of a panel convector with a baseboard heater. A heater that installs like a baseboard, but creates airflow like a panel convector would bring together the best of both worlds. This type of heater would be very similar to a traditional baseboard but, like a wall convector, would be much shorter. It would create a higher velocity of airflow and deliver heat to the centre of a room quickly.

Advances in convection

One manufacturer has launched a new linear convector that promises the best combination of panel convector and baseboard heater, as the overall length has been reduced by as much as 42% while increasing airflow by up to 40%.

From a contractor's point of view, the product's smaller size provides more options as to where it can be placed. Traditionally, electric baseboard heaters have been installed under windows (which is still a viable location), but a shorter unit can be placed just about anywhere in the room. Smaller units are also easier to handle, store and transport. They will require less packaging, which would cut the amount of waste that has to be carried away from the site.

With more clean and renewable energy coming online every year, the future of electric heat is bright, especially for those who are prepared to challenge conventional wisdom. More effective design and better performing products are breathing new life into electric heating technology. As a result, today's consumers can enjoy more comfortable homes, quieter living spaces and lower energy bills—all while reducing their impact on the environment. **EB**

Kelly Stinson is manager of R&D and Renewable Products at Dimplex North America (www.dimplex.com).



RON COLEMAN, B. Comm., FCCA CMC |

Choosing the right customer

If working with A-type customers is critical to your success, why do you have so few of them?

In business, we too often let the customer decide from whom they will buy. It is our business! We should have more say in the matter. We cannot control our businesses if we do not control who buys from us. This is why you get all those flyers with your community newspaper; advertisers are trying to get you to choose them.

For many businesses, mass advertising is not the way to go. This is particularly true for contractors and those who sell to contractors. The better way is to ensure you are focusing on the right customer.

Developing a strategy for identifying prospects and quickly categorizing them will enhance the quality of sales. Once you have done this, you can focus on the best prospects and getting the greatest return for your investment of time and money.

I ask contractors how they choose their customers. The answer, as above, is that the customer often chooses them. The downside, of course, is they are putting the customer in the driver's seat.

They are usually given a set of drawings from an existing client to price. Even when they are not too keen on pricing the job, they are afraid to say "No", fearing the client won't invite them to bid the next job. I explore these particular contractor-client relationships, and ask my contractors to explain why their client would not ask them to price future work.

Surely, if they have a good relationship with that client, he will understand why the contractor will not price certain jobs and, in fact, appreciate this. On the other hand, when the client is only looking for a cheap price, he will be upset.

Is it not okay to upset someone who is only coming to you because your price is low?

Granted, it is extremely difficult to get away from someone who likes you because your prices are low and your work is good. This is why I brainstorm with my contractors to help them develop a profile of their ideal customers: their A-list. Depending on the type of work, the right customer/prospect:

- focuses on value over price; looks for quality service,
- is a repeat customer, or a very strong referral,
- wants the type of work at which you are very good,
- desires an ongoing relationship with you,
- wants you on time, on budget and working to standard, and
- looks to you for advice.

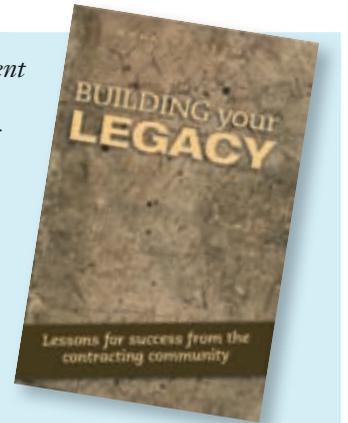
I then ask contractors to look at their customer list and score each customer according to these criteria. Afterward, we do the same with proposals they are considering, and I encourage them not to quote the weakest ones. This way they build a stronger, better-quality customer base and add a lot of value to their businesses. It also helps them focus on the core values of their businesses.

I also encourage them to head-hunt quality customers.

Takeaways

Develop a profile of your A-list customers, then develop a strategy for delighting them. Avoid anything to do with your D-list customers (apart from sending them to the competition!). Then, see what you can do to move your C-list up to B, and your B-list up to A. **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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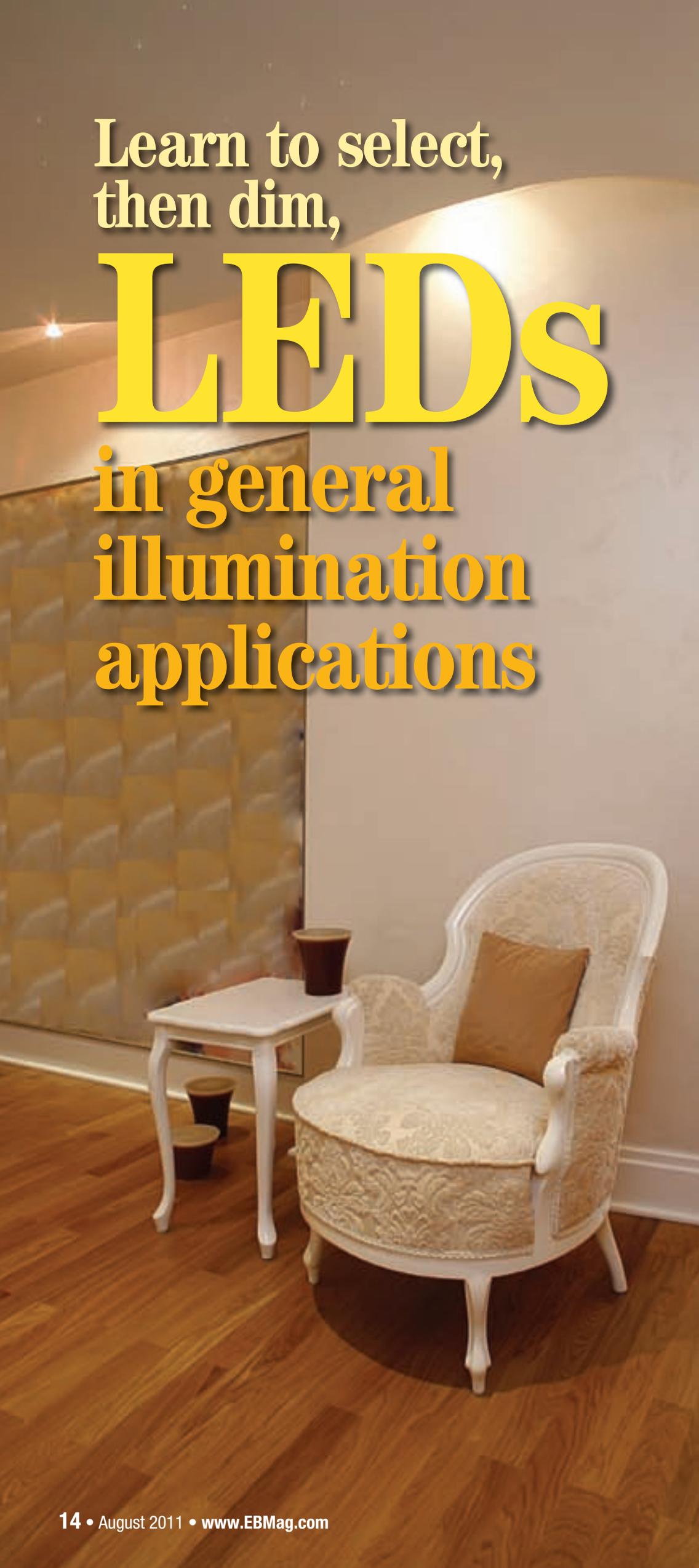
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Learn to select,
then dim,
LEDs
in general
illumination
applications

Ten years ago, many people didn't even know what an LED was. Today, they're the new hot item on the shelves—and everyone wants to use them. Often, designers do not know how to control LEDs, or they have had negative experiences working with them. This white paper will provide a brief overview of what an LED is and how to use LEDs for general illumination applications, and the advantages and limitations.

It will also explain why you should consider dimming LEDs, and what questions need to be addressed for dimming LEDs to meet your expectations. The objective is to make you more comfortable with using LEDs on your projects.

What is an LED?

A light emitting diode (LED) is an electronic device that produces light when an electrical current is passed through it. The wavelength (or colour) of light emitted depends on the materials from which the LED is made. LEDs are available in many colours, including red, blue, amber, green and near-UV colours, with lumen outputs ranging from 10 to 200.

The LEDs used predominantly in general illumination applications are “Phosphor Converted Blue” LEDs, which are blue LEDs that have a layer of yellow phosphor placed over the LED. The phosphor absorbs some of the blue light, and emits yellow light. When the unabsorbed blue light mixes with the yellow light it creates what your eye perceives as White light.

Advantages and limitations of LEDs for general illumination

Advantages

- High efficacy (lumens per watt, LPW): LED-based lighting fixtures can achieve efficacies ranging from 25 to over 80 LPW compared to an incandescent efficacy of 5 to 10 LPW.
- Longevity: LEDs can achieve useful lifetimes ranging from 25,000 hours up to 100,000 hours compared to about 1000 hours from an incandescent.
- LEDs do not contain hazardous materials as compared to mercury vapour in CFL bulbs.

Limitations

- Higher cost: High brightness LEDs, necessary for general illumination, are expensive. They also require electronic drivers to convert conventional AC voltage to discrete DC voltages for the LED arrays.
- Limited applications: Due to the relatively young technology and timeline for wide acceptance, LED-based lighting fixtures are not always available for every application or aesthetic requirement.
- Controls compatibility: Due to the range of LED-based lighting product types, not all LED lamps are dimmable, and the ones that can be dimmed may be limited in dimming performance and system compatibility.

Why dim LEDs?

Similar to fluorescent, incandescent and other conventional light sources, dimming LEDs saves energy at a roughly 1:1 ratio. This means that if you dim LEDs down to 50% of their light output, you will save nearly 50% of your energy usage. So not only do you save by using a more efficient source, you save even more energy by dimming LEDs.

Dimming LEDs also makes them run cooler, which should extend the life of the electronic components of the driver, as well as the phosphor on the LEDs. This will double or triple the LEDs lumen

maintenance. Research is ongoing to better quantify the relationship of dimming LEDs and lifetime extension.

Dimming any lamp, be it incandescent, CFL or LED enhances ambiance, so whether you are in a restaurant, theatre or presentation space, you can create the environment that the lighting designer intended. Other benefits include:

Space flexibility

Dimming control systems provide for space flexibility so that what may be an office space today could easily be converted into a call centre tomorrow, or a gymnasium can be used as a theatre or cafeteria just by adjusting the control of your lighting. Your home and your workplace should be designed to complement your needs. As your needs change throughout the day, your lighting should adapt as well: bright to read a book, but dim for computer use.

Enhanced safety

Lighting controls can enhance the safety and security of your home. You can control both interior and exterior lights from the car as you approach your driveway to ensure optimal visibility, and can even connect to security systems to turn on lights in case of an emergency.

Increased productivity

Lighting control also increases productivity, allowing the user to select the level he requires to reduce eye strain and fatigue so he can work at peak performance longer, or so students can concentrate better at home or at school.

Questions to ask when trying to dim an LED product

Before you commit yourself or your customer to investing in LED technology you need to understand its limitations, especially when it comes to dimming control compatibility. Many LED luminaire manufacturers are new to the lighting industry and are not familiar with the multitude of control types and the corresponding product design requirements. This has resulted in so-called dimmable products that do not work as claimed, that never turn off completely, or that flicker.



Lutron's Experience Center provides visitors the opportunity to experience and learn about a variety of product applications, including controlling high-efficacy lighting sources, sustainable light control options, and daylight harvesting strategies.

These are major problems that need to be addressed so that consumers do not associate all LEDs with poor performance and become averse to using them. High-performing LED products do exist, but you need to ask the right questions to make sure you select these products appropriately. Answering the following five questions will help you to align your expectations with the potential performance of your selected LED dimming system:

1. What type of LED product am I using: an LED lamp or LED fixture?

LEDs are low-voltage devices. Therefore, additional electronic components are typically required to convert line-voltage power to a low voltage for the LEDs. These electronics may also interpret control signals, and dim the LEDs accordingly. These devices are referred to as LED drivers.

LED luminaires come in two distinct types: the LED bulb (also called an LEDi or retrofit lamp) and the LED fixture.

continued on page 18



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Lutron's Experience Center includes an open office mock-up with cubicles, a workroom, a private office, a conference room and a training space that can host up to 30 people.

continued from page 15

LED bulbs have Edison-base sockets and are meant to replace standard incandescent or screw-in CFLs. The bases of these bulbs have integral drivers that determine whether they are dimmable and, if so, their dimming performance.

LED fixtures can vary from cove lights to downlights and usually have an external driver. Some fixture manufacturers offer different driver options on the same fixture to support different control technologies or applications (such as dimmable v. non-dimmable).

There are two different types of drivers: constant voltage (usually 10V, 12V and 24V) or constant current (350mA, 700mA and 1A).

Just as their names would suggest, a *constant current driver* provides a constant current, such as 700mA, to a pre-made LED array that is designed to operate at or below that current level. This is great for a down light, sconce or other LED fixtures that use only one light source per driver (much like a fluorescent lamp with its associated ballast). Note that some drivers support multiple currents, making them more flexible when designing a fixture.

A *constant voltage driver* provides a constant voltage to one or more LED arrays connected in parallel, and is used in areas where you may have a variable amount of fixtures, such as a cove or undercabinet light. These are similar, or sometimes identical, to electronic or magnetic low-voltage power supplies (such as those used with MR16 lamps) and often have 12V and 24V outputs.

These two types of drivers are not interchangeable, and it is the design of the LED array that determines the appropriate driver. This is often application-based, but it is still the configuration of the LEDs that determines the required driver. Some drivers are manufactured to operate specific LED devices or arrays, while others can operate most commonly available LEDs. Additionally, the long-life benefits of LEDs would be reduced were the driver was not designed for an equally long life.

The instantaneous response of LEDs to changing current makes them highly susceptible to flicker, especially compared to incandescent

sources. One of the most important LED driver features to understand is the quality of the DC output voltage of the driver. Finally, be cautioned that remotely mounting the driver could result in potential voltage drops, power losses or noise susceptibility on the DC wiring that must be properly addressed.

Dimming drivers can dim LEDs via pulse width modulation (PWM) and constant current reduction (CCR), though most use the PWM method. With PWM, the frequency could range from a hundred modulations per second to thousands of modulations per second, so that the LED appears to be continuously lit without flicker.

2. What is the dimming range of the product?

Incandescent lamps dim to below 1% perceived light, which looks like an orange filament glow. The dimming range of an LED lamp or fixture can vary greatly from one device to the next. Some may dim to a minimum level of only 50%, while a different product may dim to 1%. Additionally, manufacturers will quote measured light numbers, but consumers are familiar with perceived light. What is the difference?

Measured light output is the quantifiable value of light measured by a light meter or similar device. This is the dimming percentage indicated on LED product specification sheets.

Perceived light is the amount of light that your eye interprets because of pupil dilation. The eye's pupil dilates at lower light levels, causing the amount of light to be perceived higher than measured (i.e. 20% measured light equals 45% perceived light). The equation for determining perceived light is to take the square root of the measured light percentage (i.e. $\sqrt{0.2} = 0.45$).

You need to select the dimming range of your fixture or lamp that will be suitable for your application. A product that dims to 20% measured light (45% perceived) would not make sense in a media room, but may be the energy-saving solution necessary for an office.

When an LED fixture or lamp spec sheet does not state the dimming range, you should

contact the manufacturer for that important piece of information. (The Lutron testing report cards [www.lutron.com/LEDTool] include perceived as well as measured light).

It is important to note that the dimming range of a product is based solely on the driver. The integral driver will determine the dimmability of a screw-in LED retrofit lamp and an external driver will determine the dimmability of an LED fixture. Each dimmer may have varying features that will affect your ability to trim out flicker (if it exists) and minimum load requirements, but it will not affect the dimmability of a product. The driver will determine the low-end light level and the performance.

Finally, be aware that the dimming range of a single product may vary based on the control used.

3. What is the dimming performance of the product?

Each manufacturer defines dimming differently, but what you need to know is whether the dimming will be distracting or have noticeable, unexpected drops in light. The public's experience with incandescent dimming is that it is smooth and continuous. Specifically, a change in the control (dimmer) position should be reflected by an equal change in light level. There should be no abrupt change in light level as the light source is being dimmed.

Even more important is ensuring there are no points of flicker in the dimming range. Flicker is the unexpected modulation of light level that is visible to the human eye. It can come from many sources, including line noise, control noise, component tolerance and LED driver circuit design. Flicker can be continuous (happening all of the time), or intermittent (only happening some of the time or at certain light levels). A good driver should account for all of these factors and still provide flicker-free, smooth and continuous dimming.

Other undesired behaviour can occur when dimming an LED. A properly designed driver should not have any of the following problems:

- **Pop-on:** After being dimmed to a low light level and switched off, LED bulbs sometimes will not turn on until the dimmer's slider is

moved up. This is referred to as “pop-on”, which is especially challenging in 3-way situations where lights can be turned On/Off from different locations—not just using the dimmer.

- **Drop-out:** There should be no “drop-out”, so the light should only turn off when the switch is turned Off. This can be achieved by utilizing the low end trim settings available on many wallbox and system level dimmers to ensure that the lights remain on at their lowest light level at the bottom of the dimmer’s travel.
- **Dead-travel:** Adjusting the control without a corresponding change in light level is undesirable.
- **Audible Noise:** Buzzing from the lamp, or from the dimmer due to the lamp.
- **Shimmer:** Small changes in light intensity. This can usually only be noticed at medium to low light levels, and often only at the periphery of vision.

4. What is the minimum/maximum number of LED fixtures/lamps that can be connected to one dimmer?

A common problem with LED system operation involves overloading the driver. LED drivers are rated for a maximum load (in volts, amps and/or watts) that must not be exceeded. Similarly, some LED drivers may not perform well when too little load is put upon them.

The number of lamps able to be installed on a single-phase control dimmer may seem like an easy question to answer, but it’s not as simple as looking at your 600W dimmer and dividing 600 by the 15W LED lamp you have selected to determine that 60 lamps can be used on that circuit.

You may only be able to use 100 watts of the LED load on a dimmer rated for 600 watts. While the LED lamp may only draw 10 watts continuously, it may have a start-up inrush current or repetitive current during every half-cycle that makes it appear much worse. That 15W LED lamp will appear to the dimmer as a 100W incandescent load, so were you to use more than 90 watts of that LED, you would overload the dimmer.

Neglecting this transient current can put significant stress on the dimmer and can cause premature product failure or undesired system performance (such

as excessive acoustic noise). This transient electrical stress may limit the maximum number of lamps you can install on one dimmer.

A minimum number of fixtures may be required to operate a dimmer because of the 25W to 40W minimum load most incandescent dimmers require to operate correctly under all conditions. When using incandescent bulbs, the minimum load requirement was easily met with usually only a single bulb. With LEDs, however, four or more loads may be needed on a dimmer to meet the required minimum load.

5. On what type of control does the LED product operate?

The following control technologies refer to the signal and wiring between the control on the wall and the fixture or lamp. LED retrofit lamps generally only use forward- or reverse-phase control technologies. LED fixtures may use any method, independently of driver type (constant current or constant voltage).

The compatibility of a dimmer with a particular LED fixture begins with making sure they both use the same control method. These control technologies are used in standalone applications and control systems, as well as in wired and wireless lighting control systems. Controls that use phase control to control a lamp may also use a wireless technology to communicate between loads or within an entire home lighting control system.

Forward-phase control

Typically used for incandescent and magnetic low-voltage (MLV) light sources, this is the most common method of dimming control. The National Electrical Manufacturers Association (NEMA, www.nema.org) estimates there are about 150 million forward-phase control dimmers installed residentially, and many of these are likely to control LED replacement lamps in the future.

Working well with forward-phase control is critical



Lutron's Washington, D.C. location is the company's fifth Experience Center. Other locations include Irvine, Calif.; New York, N.Y.; Coopersburg, Pa.; and Plantation, Fla.

to the success of LED bulbs because of the huge existing installed base. Unfortunately, these controls were never designed for LED lights and are not UL listed to operate LED lights, so the performance is hit-or-miss and, in many cases, will cause LEDs to flicker, drop out, pop on or not dim very well. These dimming controls may also require multiple lamps per control to meet the minimum load requirements.

However, new forward-phase control dimmers have entered the market that have been specially designed to reduce or eliminate the problems seen with controlling LED loads on existing incandescent dimmers. These dimmers are UL listed with specific LED loads, ensuring an acceptable application.

Reverse-phase control

Typically used to control electronic low-voltage (ELV) light sources, reverse-phase control is best for capacitive loads such as LED drivers. While it does not have the installed base that incandescent dimmers have, this control type is often more successful at high performance LED dimming without flicker.



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Reverse-phase dimmers were designed for the lower power “electronic loads” of electronic low-voltage transformers, so they tend to work better with the drivers required for LED loads. Unfortunately, these controls nearly always require a neutral wire to power the internal electronics, and not every electrical back box has a neutral present. Installing reverse-phase dimmers in older buildings may require that a neutral wire is pulled to the box. Furthermore, these types of controls are not as widely available in the marketplace and are generally more costly.

3-wire control

This standard fluorescent control type is used by dimmers that were created for fluorescent dimming. Three-wire controls have a separate line voltage wire that carries the phase control signal separate from the power wires.

Three-wire is more precise than forward or reverse and the control signal is much more immune to electrical noise. There are over 30 years of history in the industry of using 3-wire controls to dim fluorescent ballasts to 1% without flicker, drop out or pop on. Of course, to get this performance, a third line-voltage control wire must be pulled to the fixture.

0-10V control

This analogue control standard has been used in energy management controls such as occupancy and daylight sensors, and is now becoming popular with many LED products. This control type is isolated and considered low-voltage class 2, enabling it to be safe to the touch and allowing for simplified wiring.

One of the benefits of 0-10V controls is that it is defined in the IEC standard number 60929 Annex E. Unfortunately, some manufacturers don't follow this standard. This leads to drivers and lamps that claim to be 0-10V compatible but drop out or pop on, or that dim backward with the lowest light at the top of the control and the brightest light at the bottom. Some 0-10V products do not work at all with controls designed for 0-10V ballasts, which are the majority of installed 0-10V controls.

Since the control signal is a small analogue voltage, long wire runs can produce a significant drop in the signal level resulting in different light



Lutron's new Experience Center in Washington, D.C., features an expandable line of Lutron light control products presented in a fully functional and versatile commercial office.

levels from different drivers controlled by the same control device. Note also that the IEC standard only defines the electrical performance of the protocol; it does not define the aesthetic performance (i.e. lack of flicker) or low-end light level.

DALI/EcoSystem

The DALI digital standard originated in Europe for controlling fluorescent ballasts, but is now commonplace in commercial buildings in the United States. DALI is also defined in IEC standard 60929 Annex E. It allows for the digital control of individual fixtures, maximizing the user's control and productivity. (EcoSystem incorporates Lutron enhancements to the DALI protocol.)

EcoSystem and DALI provide addressing of individual fixtures and status feedback from the drivers. This makes it easy to digitally assign occupancy sensors, daylight sensors, time clocks, manual and other controls to one or many fixtures without complicated wiring. This opens up an entire suite of energy-saving and system-monitoring control schemes where the design and setup is all done within software, making designing with them simple.

EcoSystem simplifies the programming process by allowing you to use a hand-held device in the space and not have to know details of the system, such as addresses. Again, the IEC standard only defines electrical, not aesthetic, performance.

DMX

Typically used in theatrical applications, DMX remains popular with RGB LED applications where multiple channels are necessary for individual colour control. Some manufacturers are using DMX as the control type for white light in general illumination applications, which can often be complicated in terms of wiring, addressing and interacting with other controls in the space. Contact the manufacturer for more information about how DMX controls can be integrated with control systems. Integrating between general lighting control systems and DMX fixtures is possible, but can often be complicated.

Conclusion

Just because a fixture and the desired control use the same control technology (i.e. 0-10V), it does not mean they will perform well together. This is especially true with forward- and reverse-phase control, due to their lack of a formal standard. However, even control technologies that have a standard do not indicate anything about performance—they only pertain to compatibility.

The only way to know for certain whether a particular LED lamp or fixture will work with a particular dimmer is to test it and determine whether negative behaviour, such as flicker, pop-on, dead travel, etc., will occur. Keep in mind that you will not be able to visually determine the inrush current of an LED product, so you must find out from the manufacturer or limit the number of lamps you are using to avoid overloading the dimmer.

The Lutron LED Control Centre of Excellence (COE) can assist in determining compatibility. The COE tests many fixture/driver/control combinations and posts the results online. All of these results are captured in the LED Product Selection Tool (www.lutron.com/LEDTool), which allows you to search by several different criteria.

Many manufacturers (both LED luminaire and control) conduct compatibility testing of their products. It is up to you to determine whether their assessment of “good dimming” meets your needs. **EB**

Adapted from a technical white paper by Lutron's Amanda Beebe and Ethan Biery. Visit www.lutron.com and www.lutron.com/LEDTool.

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Security options for coping with copper theft

Linda Johnson



It's no wonder police departments concerned about the rising rate of copper wire theft keep calling for laws aimed at scrap metal recyclers.

Ever since metal prices began their ascent on world markets, thefts of the lucrative wire and cable have proven difficult to stop at the source. Dark, secluded crime scenes and easy access have been a boon to thieves set on stealing copper supplies from warehouses or on ripping electrical systems off store walls.

And access is still sometimes easy enough that thieves will risk their lives pulling ground wires out of cell tower compounds and cables from electrical transformer stations.

Conventional security systems have proven largely ineffective in stopping the thefts. But now some companies are finding a way to keep the thieves out and the lights on by turning to two advanced technologies: "verified" surveillance and broad-spectrum wireless.

Many companies with copper stocks are opting for remotely monitored video, says Joe Wilson, president and CEO of Sonitrol Canada.

The company, which specializes in verified video and active audio systems, has seen its metal-related business increase by 30% in the last three years, he says. Many of these new customers are electrical and plumbing suppliers, cell tower owners, utilities

and construction businesses.

"The conventional alarm guys will sell them a CCTV system that's just a recorded video feed. The problem with that is there's no value in coming in the next day and watching someone steal your copper," says Wilson.

In Sonitrol's video system, Sonavision, cameras connected to temperature and motion sensors are placed around the perimeter of a compound. When

these sensors detect warmth or movement, they begin sending video to an operation centre, where staff check to see what kind of intruder it is.

If it's a raccoon, they reset the alarm. If it's a person or car, they connect directly into the police. Officers there can see what's happening and respond to the alarm.

In vacant buildings, Sonavision is often deployed with audio

sensors, says Wilson. Each sensor in Sonitrol's Active Audio system listens 50 feet forward, 40 feet sideways and 30 feet backwards, floor to ceiling, so the system can cover about 5,000 square feet unobstructed by walls. Sensors can differentiate between ambient sounds — those made by animals or weather, for example — and sounds made by human intruders. As soon as a thief arrives and starts to break in a window or door,



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the sensors trip, and operators start feeding the sound to the police.

Response time is usually 3 1/2 minutes, says Wilson, because the police know it's not a false alarm. Sonitrol's false alarm rate is only 3%, compared to 98% with conventional systems.

"The police hurry up to us because it's verified. That means we can verify there really

is an event, and the verification is either us watching through Sonavision or it's through audio," he says.

For a typical commercial building, Sonavision with audio costs between \$5000 and \$10,000, says Wilson. Customers can also rent products and pay a monitoring fee of \$100 to \$400 a month.

James Weldon, owner of JTW Consulting, a private consulting firm in Vancouver, has often seen the damage that thieves cause. He says

it's important to stop the theft early in the act.

In December, thieves broke in to Weldon's new \$1.5-million renovation project, stripping out all the wiring, including the panel wiring. That would normally mean rewiring the entire building and repairing many damaged structures. Fortunately, they were planning to change the electric system anyway, he says.

"You can be close to drywall and all your electrical and plumbing is in, and somebody comes in and maliciously strips everything out," he says. "That's a typical equation. They weigh that copper in for \$1000, and it costs the unfortunate person who has to repair it up to \$50,000."

About a month later, after the site had been equipped with Sonavision, another break-in occurred. This time the intruder was caught on video and was quickly arrested.

"I think that's what Sonitrol does. They're monitored and within five minutes, before they can do serious damage, the police are here. And they tell them, 'we know you're in the building, we know what you look like, we know what you're wearing. Just come out and give it up,'" he says.

The quick response time makes the system a good deterrent, Weldon says. After an arrest, word goes around fast—break in there and you'll be caught almost as soon as you get in. And the system has saved him money. On the \$1.5-million project, it was installed for \$14,000, while a guard would probably have cost \$50,000 to \$60,000, he says.

Another technology, advanced wireless, has proved effective in preventing copper wire theft in retail malls and outdoor areas—cell towers and construction sites—as well as electrical and plumbing compounds, says Mark Jarman, president of Inovonics. The company, one of the first to use 900 MHz, specializes in wireless sensor networks. Its EchoStream radio technology is designed for large commercial and retail buildings.

"With a spread spectrum technology, particularly frequency hopping, you can get around the challenges you come across (metal and even concrete structures) to get radio transmissions through commercial buildings," he says.

The system uses a repeater network, Jarman says. Repeater devices, mounted above ceiling



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level, hear a primary message from a sensor and pass it on to a transceiver, which is connected to a control panel in a security system.

“And you can actually put a whole constellation of these things into a commercial complex and cover the entire building—even a high-rise,” he says.

Jarman says many customers with copper product are choosing to add on, or hybridize, the wireless capability to their existing networks. The result is something like having a control panel on a radio receiver. The sensors are registered to the receiver, and the receiver expects to hear from them in a given period of time.

“If it doesn’t hear from them, it sends an alarm message in the form of a relay output that can be put onto any control panel,” he says.

While wireless devices are more expensive than wired, labour costs are lower, says Jarman.

Many businesses are finding that their existing security system, designed solely for interior detection, is not enough, says Jarman. With an add-on receiver, a client can add a perimeter beam around the edge of a property. Outdoor wireless systems are being used in supply compounds, at cell towers, and at any site where the danger of electrocution makes it important to detect someone before they get over a fence.

Inovonics transmitters are put into infrared-based beamed detection devices, made by Optex, and mounted outdoors, around the perimeter of the property. The technology of the perimeter beam is very good, Jarman says.

“Optex and we and a lot of dealers are gaining a great deal of confidence in their efficacy to detect someone penetrating the property.”

Sometimes, wide range radio technology is the right option simply because it can go where wired systems cannot. That was the situation in a commercial area of Albuquerque, N.M., where storeowners often arrive in the morning to find their electrical systems gone. But then, the security company of one store, Accent Southwest Windows and Doors, installed Inovonics devices inside the outside utility box, and thefts at the store stopped completely.

“We added the switches inside the enclosures, and as soon as someone tries to tamper with the enclosure—even before they can begin to cut the wire—we’re

getting a signal. And that signal is being transmitted to our central monitoring station so that our officers can begin responding,” says Dave Meurer, president of Armed Response Team.

With the wireless devices, they overcame the main problems they faced with a wired system: mixed voltage and the need to drill through the steel enclosures. After testing many wireless products, they selected Inovonics, mostly because of the range of the transmission signal, says Meurer.

“It’s not a line-of-sight situation; it’s inside a steel enclosure, so you have to make sure you have an adequate signal strength to get that message to connect back to an alarm receiver inside the building,” he says.

Wilson says Sonitrol is producing better and faster video transmitters, as well as stronger audio sensors, while Meurer describes the Inovonics wireless as the “game-changer” in his search to devise an alarm. Good news. Because copper theft is a crime that’s likely to continue. **EB**

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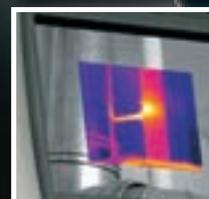
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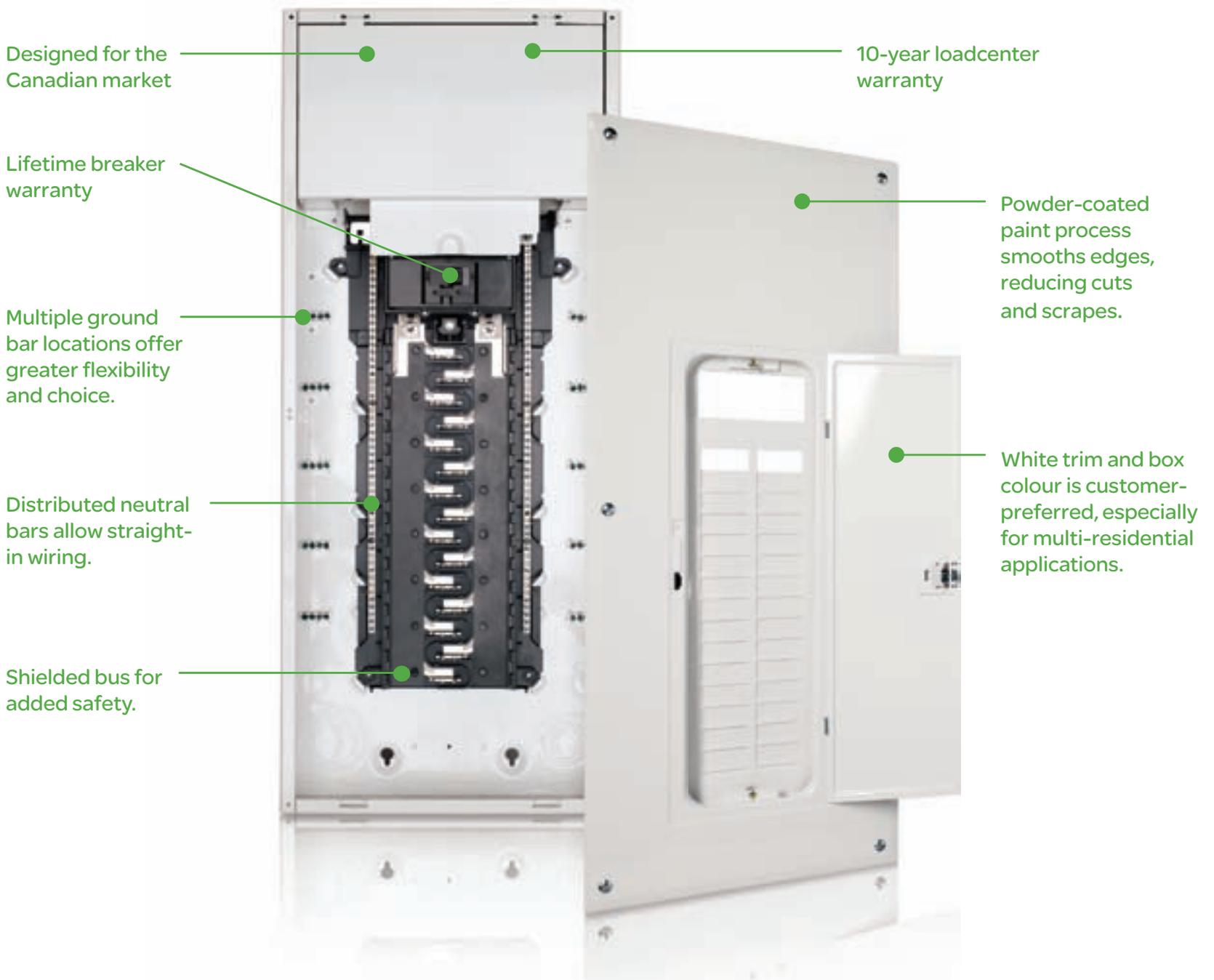


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The Calgary Airport Authority (CAA) is a not-for-profit, non-share capital corporation responsible for the management, maintenance and development of Calgary International Airport (YYC). The facility is an important economic engine for the city and province, generating more than \$6 billion in economic activity. The airport has the most extensive passenger service network in central Canada.

In 2009, CAA opened a new onsite seven-level covered parking structure as the final phase of its Parking Made Easy program. The 56,950-m² (613,000-sf) facility is the first all-LED parking building in the country. In 2010, it received awards from both the Illuminating Engineering Society (IES) and the Precast/Prestressed Concrete Institute (PCI).

The project did not pursue certification under the Canada Green Building Council's (CaGBC's) Leadership in Energy and Environmental Design (LEED Canada) program because, to qualify, a building must be a minimum 10% occupied. However, the designers still aimed to have its operations run as sustainably as possible.

One of the key features incorporated into the facility included the implementation of LED lights to dramatically reduce power consumption and maintenance costs. The 816 canopy luminaires and 28 LED area lights reduce energy consumption more than 50% from the previous base design that used 150W high-pressure sodium (HPS).

Due to the advantages of the LED luminaires and the overwhelming response to the bright, white light, CAA decided all future projects requiring lighting will specify LEDs. For example, solar LED airfield lights are being installed as part of a massive facility upgrade. A new International Concourse, expected to be completed by 2015, will incorporate sustainable design principles, reduce energy consumption and minimize environmental impact.

The first-phase installation includes solar LED airfield lights fitted with blue LEDs for taxiway edge lighting that can be easily relocated as airfield construction demands.

Project overview and photos courtesy BetaLED, www.betaled.com.

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Stray voltage can be found in any electrical system and is strictly a power distribution issue; improper grounding causes low voltage current to travel along a neutral wire. An electrical wiring system is grounded to keep voltage potential differences between the neutral wire and the ground below levels that could be considered harmful.

While the potential exists for stray voltage in residential areas, it is most commonly found at agricultural operations, and is often attributed to poor grounding of the neutral wiring system in an environment where the presence of water increases conductivity between points of contact.

Stray voltage is unwanted electricity that, in some cases, can pose a safety risk to animals—and humans, to a lesser degree—that come into contact with it.

Farming operations are especially susceptible to incidences of stray voltage for two key reasons:

1. Many working farms have electrical systems and wiring that have not been fully updated to current electrical codes and standards.
2. Farms have a higher number of potential contact points (i.e. metal), water and wet conditions (i.e. feed bowls and wet concrete floors).

What’s in a term?

The term ‘stray voltage’ is often misused due to a poor understanding of its cause.

It has incorrectly been called ‘dirty electricity’, implying that some forms of electricity are better or cleaner than others. Electricity from all sources is equally ‘clean’.

Stray voltage has also been confused with electromagnetic fields (EMF), grounding systems or even naturally occurring current found in the earth.

continued on page 31

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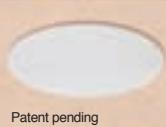
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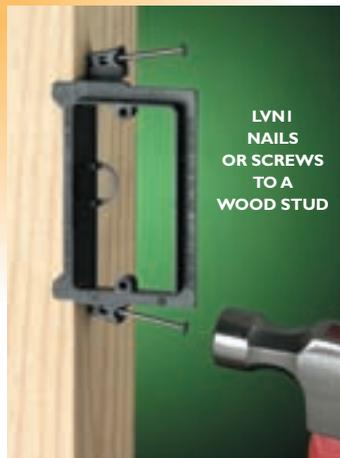
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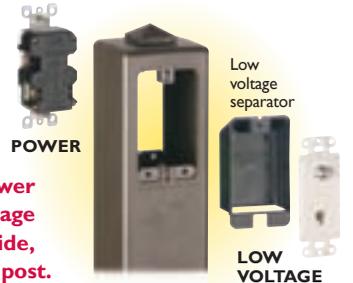
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FARM STRAY VOLTAGE:

Why the Ontario Energy Board took action

On June 22, 2007, OEB received a directive from the Minister of Energy requiring it to implement measures it considered necessary to address the issue of stray voltage in the farm sector. In response to the minister's directive, OEB began a consultation process to solicit input from interested parties regarding stray voltage, its potential impact on the farm sector and the identification of potential measures to mitigate this impact.

As a result, the board approved amendments to the Distribution System Code that include:

- Distributors must investigate farm stray voltage complaints using qualified people.
- A specified distributor investigation procedure must be used to determine whether problem levels of farm stray voltage are present and, if so, whether the distribution system is contributing in excess of a specified threshold.
- Where a distribution system is found to contribute to stray voltage on a farm in excess of a specified threshold, the distributor must take steps to reduce stray voltage to acceptable levels.
- Distributors serving livestock farm customers must prepare and make available a farm stray voltage "customer response procedure" that sets out the process for responding to farm stray voltage inquiries and complaints from customers.

As for cost impact, the OEB believes that codifying the distributor investigation procedure will add somewhat to the cost of distributor farm stray voltage investigations, but that these incremental costs will be offset by savings realized by avoiding the retesting associated with disputed test procedures and results.

DAIRY FARMERS want training and certification

Ontario Hydro One Networks used to have some of the top experts on stray voltage on staff. They developed the initial Hammond Filter which eliminated a lot of stray voltage issues on the farm. Unfortunately, with time and cutbacks, these experts have either left the company or simply retired. Only recently, since the stray voltage issue resurfaced, has Hydro One put in a training centre for its own employees.

Even the Electrical Safety Authority (ESA), which used to be part of Ontario Hydro, has very few experts on stray voltage. Because of the recent interest, some ESA engineers are now getting trained.

In the last few years, we had so-called stray voltage 'experts'—some of them armed with specialized instrumentation—running around the country making questionable recommendations. Other so-called experts put in special devices on windowsills to supposedly 'chase away' electromagnetic fields and stray voltage on farms. The point is that some of these so-called 'experts' may or may not do a lot of good.

It is difficult and frustrating for a farmer with a real stray voltage issue to distinguish what is true and what is false, and solid recommendations based on science. Anybody can call himself an expert. But not everyone can show a

recognizable document to prove it. A lot of misinformation is out there simply because there are

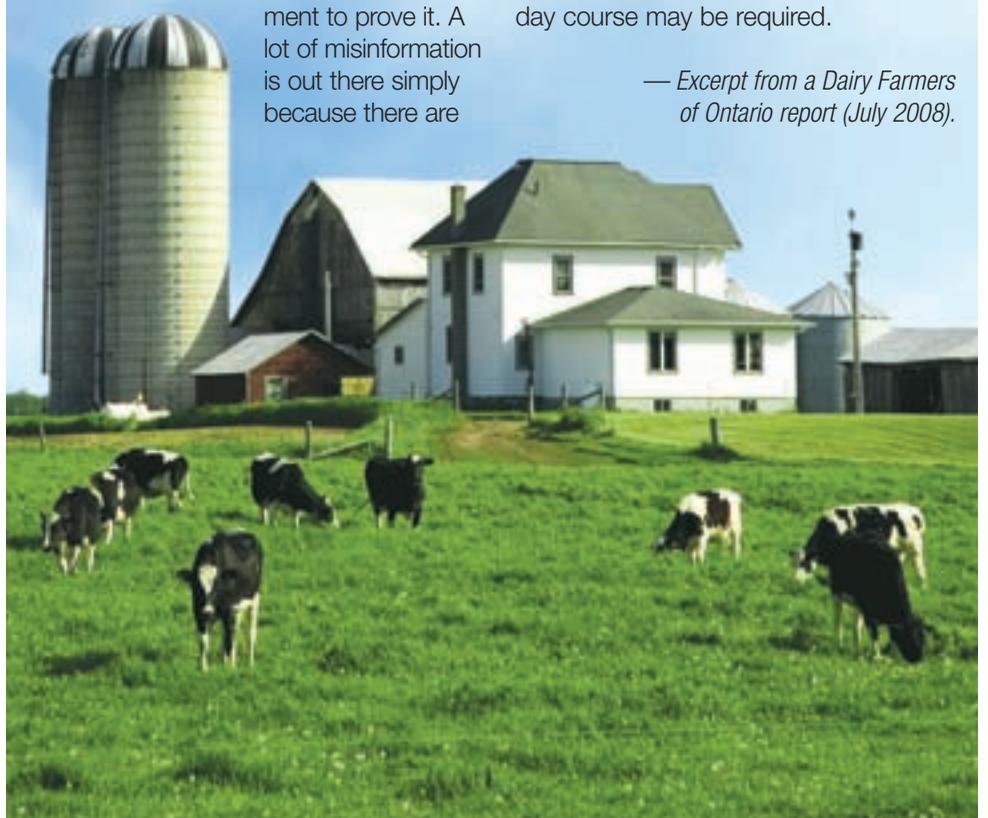
no certified experts that would put their reputation on the line to find and solve stray voltage issues.

Therefore, requiring Stray Voltage Expert Certification in Ontario is a must. Properly trained experts will take away all the uncertainty of what is presently in the marketplace. They will be recognized by all parties if they identify a stray voltage issue and the source of it. This will make the solution so much easier to solve. Some independent stray voltage experts must be part of the group, to allow farmers to choose, at their own expense, independent experts not affiliated with any electrical distributor.

In the end, Ontario will not need that many certified stray voltage experts. Fewer than 50 engineers and top electricians are most likely needed to cover the whole province of Ontario.

However, training is also required for electricians and distributor technicians in finding stray voltage issues and installing stray voltage device remedy equipment. Training is required for these electricians to monitor or identify possible stray voltage issues. Cow contact point stray voltage measurements, equipotential gridding, proper grounding techniques, leakage verification, etc., could be part of the course at a practical level. But certification for these electricians and technicians may not be needed. Only a very short one-day course may be required.

— Excerpt from a Dairy Farmers of Ontario report (July 2008).



Animal reaction to stray voltage

Stray voltage may affect farm animals through nerve stimulation, causing a tingling effect.

This so-called 'tingle' can occur when the animal comes into contact with two points that have a voltage potential, such as a metal dish filled with water and a wet concrete floor, creating a path for current (electricity) to flow through the animal.

This nerve stimulation may have a direct effect on an animal's behaviour i.e. in the form of involuntary muscle contractions and/or pain; or indirectly in the form of behavioral responses, such as reduced food and water intake, or proving difficult to handle.

All electrical current must be respected as potentially harmful and stray voltage, although present in low amounts, is no different. Based on research, levels below 1 volt are considered to be inconsequential, and generally not believed to cause behavioral changes in farm animals.

Detecting and repairing incidences of stray voltage

In most cases, the source of stray voltage can be identified, allowing it to be either mitigated or eliminated.

Suspected cases of stray voltage should be investigated by an inspector from a local utility operator, as it is a common distribution issue for farm operators as a result of inconsistent wiring quality. A utility inspector will investigate the farm's existing wiring system to ensure proper installation, wire condition and code compliance. An inspector will seek to isolate the source of neutral-to-earth (ground) voltage by measuring voltage at various points within the electrical system. This helps determine whether the issue is related to on-farm wiring and distribution, or related to the electrical distribution system off the farm.

Countering incidences of stray voltage in Ontario

In 2007, the province of Ontario began an extensive research and consultation process into the phenomenon of stray voltage and its effects on the farm sector. In 2009, the Ontario Energy Board (OEB) enacted code amendments detailing procedures and methodology for dealing with incidences of stray voltage.

As part of its two-year research and consultation process, the OEB employed Dr. Douglas J. Reinemann, a professor of Biological Systems Engineering and a leading authority on stray voltage to review studies and literature on the subject.

Recognizing stray voltage's

connection to farming operations, Reinemann sought to further clarify the term 'stray voltage' by further defining it as "... a low-level electrical shock that can produce sensation or annoyance in farm animals". He also further specifies the term as "a special case of voltage developed on the grounded neutral system of a farm".

Stray voltage and wind energy

There has been much confusion on the topic of stray voltage, and wind turbines have at times been inappropriately linked as direct sources of stray voltage.

Stray voltage is a potential symptom in any system of electrical distribution, regardless of source and is especially prevalent on working farms. Wind turbines are often located in agricultural areas, connecting to the provincial electricity grid with farm operators leasing the land on which the turbines sit. Through improved regulation and electrical code enforcement, incidences of stray voltage will be increasingly detected and eliminated. **EB**

Paper courtesy CanWEA (Canadian Wind Energy Association). Visit them online at www.canwea.ca.



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IP video surveillance and wireless networks:

A SUCCESSFUL PARTNERSHIP



Wireless IP video monitors offshore fish farm.

Oliver Vellacott

One of the many benefits of IP video surveillance technology compared with traditional analogue video equipment is that digital video is compressed and streamed across standard ethernet networks using the internet protocol (IP). This is exactly the same protocol as used on corporate networks and the internet. Digital video can therefore be transmitted across any broadband network connection, i.e. cable, fiber or wireless.

There are a number of wireless technologies that allow digital surveillance video to be easily transmitted across large urban areas and from remote locations. As far as the IP video system is concerned, the wireless interface is transparent and is simply a replacement or extension of the standard wired IP network. Connecting to a wireless network is the same as connecting to an ethernet switch.

Benefits of wireless IP video

Combining IP video surveillance with wireless networks can provide the user with a number of significant benefits:

- **No cable:** eliminating the need for costly installation works.
- **Less disruption:** with less cable to install, project timeframes are significantly reduced and business disruption is minimized.
- **Lower transmission costs:** no expensive fixed lines required.
- **Expansion and migration:** legacy surveillance systems can easily be extended using wireless IP video and provide a cost-effective solution for migration to fully digital systems.
- **Remote monitoring:** surveillance of remote locations over large distances.

- **Mobile applications:** live and recorded video from remote surveillance cameras can be viewed while on the move using 3G mobile phone networks.
- **Heritage protection:** in many historic buildings where the installation of cable is prohibited, wireless is the only alternative.

Wireless technologies

Wireless broadband networks

Wireless broadband typically operates in the unlicensed frequency spectrum and provides high-speed wireless internet and data network access over a wide area. For IP video applications, wireless broadband networks can be deployed in a number of configurations:

- **Point-to-point.** Often known as an Ethernet Bridge, it's simple link between two networks.
- **Point-to-Multipoint.** This topology allows several locations to be connected to a single network.
- **Mesh wide-area network.** This is a communications network made up of radio nodes organized in a mesh topology. They are, in effect, a router network minus the cabling between nodes, and they create a high-bandwidth network over a specific coverage area. Surveillance cameras with a wireless interface can be located anywhere within the mesh, allowing them to be repositioned as the environment changes, or to be temporarily installed in crime hotspots around an urban area.

Different network technologies, both wired and wireless, are often deployed together to achieve very wide area coverage. Chihuahua State in Northern Mexico has deployed such

a system based on distributed IP video technology. Covering nearly 100,000 square miles, Chihuahua is the largest of Mexico's states. Its capital and largest city has the same name, Chihuahua, and it includes eight other major cities. The truly distributed nature of the system allows an operator in the state capital to view video from any other city in the region from a PTZ camera he can control. The surveillance systems in each city are deployed using point-to-multipoint wireless networks. Each city is connected to the state capital via fixed network links.

WiMAX

WiMAX (Worldwide Interoperability for Microwave Access) is a telecom technology that supports wireless broadband access over large distances (many miles) as an alternative to cable and DSL. It is different from Wi-Fi, which is a shorter range system (coverage over hundreds of feet).



Outdoor wireless IP dome installation.

An excellent example of this technology is in place at the Acuicola Marina fish farm in the Spanish Province of Castellon on the Mediterranean coast. Their offices and a warehouse are located at Burriana, two miles inland, with the fish farm facilities sited six miles offshore. The valuable fish stock is a target for poachers and Acuicola Marina has always found it difficult to police the offshore facilities. To overcome this, they deployed an IP video system with a wireless network infrastructure consisting of a local Wi-Fi network covering the offshore facilities with a 7 Mbps WiMAX radio link back to the onshore offices eight miles away. As well as providing security for the fish stock, it also offers operational benefits, with submersible cameras monitoring fish stocks and food distribution.

Mobile wireless broadband

This provides high-speed internet access through existing 3G mobile phone networks. It

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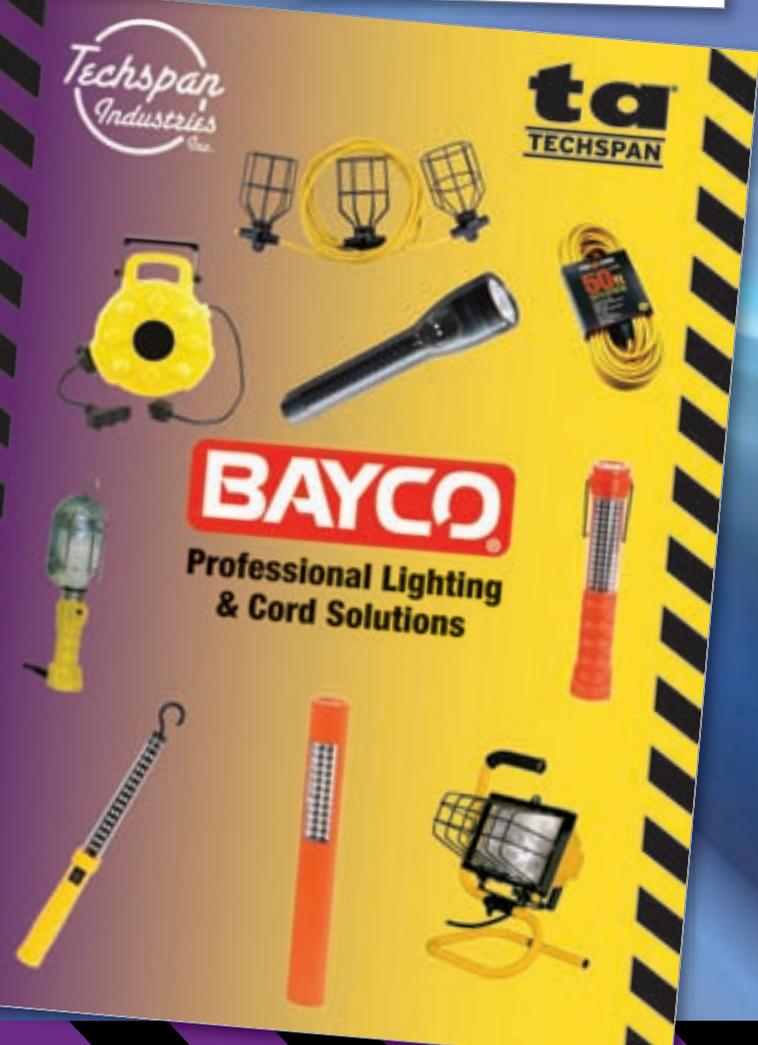
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Grand Canyon's Skywalk is being monitored using digital video streamed across satellite network links.



is an established technology that many of us use on our phones to access the internet while on the go. It can be a very powerful tool for law enforcement officers to monitor live and recorded footage from surveillance cameras on a laptop mounted in police vehicles.

This can be demonstrated by the fully integrated public video surveillance system that has been developed in the City of Lansing, Mich. Here, video is streamed at 30fps across various network technologies, including ShDSLs, fiber, mesh wireless and mobile 3G broadband. The police department's 60 vehicles each have a laptop with high-speed broadband 3G technology that allows officers to view and control any camera in the system.

Commenting on the use of mobile surveillance equipment, Lansing police chief, Mark Alley, said, "As we are always looking for ways to free up patrol time for our officers, we decided that we were going to take an aggressive approach and get the equipment out there to our officers so they can be more effective and efficient."

Satellite

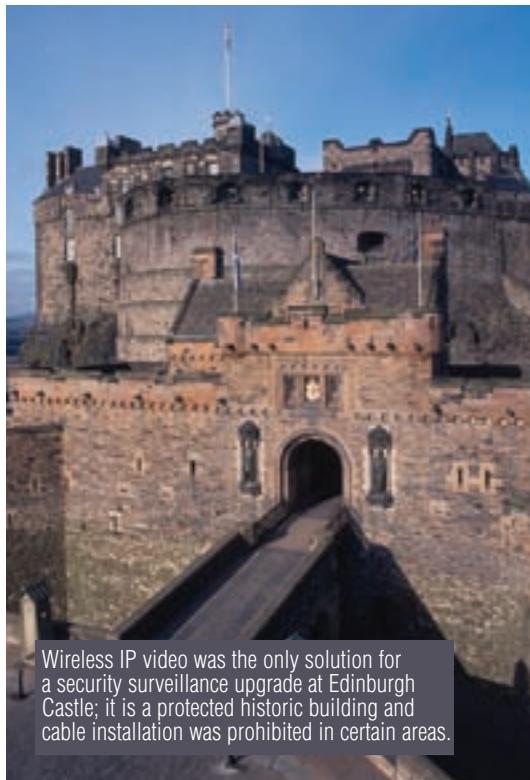
Satellite broadband access is an expensive communications solution, but is often the only technology available for remote areas. Since the data has got to travel about 20,000 miles to reach its destination, latency (or delay) can be more of an issue than with standard radio-based wireless networks. It can also be affected by weather and climatic conditions.

An innovative wireless surveillance system is helping to cut crime and provide a safe and secure environment for visitors to the Grand Canyon West Resort, Az. A distributed IP video system has been deployed at multiple sites, providing an integrated surveillance solution across a wide area. Grand Canyon West is a popular tourist destination on the west side of the canyon owned and operated by the Hualapai tribe. The resort includes Skywalk, which allows visitors to "Walk the Sky" on a horseshoe-shaped glass bridge that overhangs the Grand Canyon.

Several sites, including Eagle Point (home of the Skywalk), Guano Point, a hotel, fuel depot and airport are all centrally monitored from the airport terminal building. The facilities are located several miles apart and are completely standalone with no cabling or infrastructure between them. All the sites are powered by their own generators. Each local IP network is interconnected using a satellite broadband network.

Bandwidth

Wireless networks typically have far lower bandwidth than wired networks. A wired network can have an available bandwidth of up to 700 Mb/s, whereas wireless networks typically offer no more than 25 Mb/s. It is therefore paramount to minimize the amount of data transmitted across the wireless portion of the network. This can be achieved by ensuring that the IP video system deployed has the best compression available, is based on a distributed architecture and has features that ensure the minimum amount of video is transmitted at all times.



Wireless IP video was the only solution for a security surveillance upgrade at Edinburgh Castle; it is a protected historic building and cable installation was prohibited in certain areas.

Compression

Deploying the very best H.264-based video compression technology can make a significant difference to the performance of the wireless IP video system. This is particularly important when using increasingly popular high-definition (HD) cameras with their higher resolutions and bit-rates. The data rates from different manufacturers' cameras can vary significantly, even when comparing cameras implementing H.264. An average IP camera can transmit five or six times more data than the best-available camera for the same scene. With the limited bandwidths available from wireless networks, this is an important consideration.

Architecture

There are typically two different architectures used by IP video systems: centralized and distributed. A centralized architecture uses a master database—usually located in the central control room or head office. A distributed architecture spreads the data around the security management system, generally keeping it close to where it is produced or needed. Normally, much more data is transferred across the network to the centralized video and storage servers than would be the case with a distributed system, where video workstations

and network video recorders (NVRs) can be located at the edge of the network. Well-designed distributed systems reduce the need for large amounts of data to travel large distances, i.e. between the central network and the edge components.

Multicasting

IP Multicasting is an extremely powerful networking feature that allows video from the same camera to be efficiently viewed and recorded by multiple operators at the same time, with the same network bandwidth requirement as would be for a single operator. Using multicasting on a distributed system is an extremely efficient solution for IP video systems.

Analytics

Real-time analytics running in the cameras at the network edge can be used to reduce the amount of video that is streamed across the wireless network. When a scene is inactive, there is no point in transmitting full-frame video. Motion detection analytics can be used to detect a change in motion in a scene and automatically modify the video output stream from low frame-rate to maximum.

Dual streaming

Cameras on some IP video systems are capable of dual streaming; that is, outputting two separate video streams at different frame-rates. Typically, this could be used to transmit a lower frame-rate stream across a wireless network, while using a full frame-rate stream for recording on a local NVR.

Bandwidth management

Leading IP video systems have a set of tools for bandwidth management. These allocate bandwidth to each camera stream based on a pre-configured maximum available for a particular network setup. These tools would typically work on a WAN connection, not on the local network. In the case where the WAN connection is wireless, this can be a very useful tool for ensuring the available bandwidth is not exceeded and works well alongside features such as dual streaming, mentioned above.

Summary

The benefits of using wireless networks with IP video systems are clear and can sometimes be the only solution available for large or remote areas. However, the overall performance of the network (and, hence, the surveillance system), is very dependent on the performance, features and capability of the IP video system itself. Choosing the correct IP video technology that has good compression, the most suitable architecture and fully-featured IP cameras is very important. **EB**

Oliver Vellacott founded IndigoVision (www.indigovision.com) in 1994. He was previously a product manager with a background in intelligent camera products. Oliver studied piano at the Guildhall School of Music before gaining his first degree in Software Engineering from Imperial College London, then a Ph.D. in Electrical Engineering from Edinburgh University.

Motor and drive system resonance problems and solutions

Thomas H. Bishop, P.Eng.

Mechanical resonance occurs when an external source amplifies the vibration level of a mass or structure at its natural frequency. For a rotating mass like a motor or a pump, this occurs at the critical speed(s). Electrical resonance amplifies the magnitude of voltage or current, or both. The increase in amplitude—whether mechanical or electrical—places more stress on motor and pump components, negatively affects operation (i.e. increased vibration, instability and energy consumption), and leads to premature failure.

Fed by an external energy source, resonance may continue increasing in magnitude until a fault occurs. Mechanical resonance can break motor, drive and pump components; electrical resonance can cause motor windings to fail. This article discusses both types of resonance and provides some solutions for each of them.

Mechanical system resonance

The motor and load, such as a pump, comprise a “two-mass system”, and usually are connected by power transmission devices such as gearboxes, belts and couplings. As Figure 1 illustrates, each of these connecting components twists slightly like a spring when the motor applies torque. Mechanical system resonance, which can occur when any natural frequencies are within the speed range, is typically caused by compliance (“springiness” or lack of stiffness) between a motor and its load. Evidence of the problem includes increased vibration at a natural frequency. The motor may also emit a pure tone like that of a tuning fork, or it may start “growling” or become unstable.

Every two-mass system has at least one frequency where it wants to oscillate; that is its mechanical resonance frequency. In a variable-frequency drive (VFD) and motor application, multiple resonant (natural) frequencies are possible.

Solutions for mechanical resonance

When only one resonant frequency is an issue, a good solution is to stiffen the “springs” of the system (Figure 1) to raise its resonant frequency. This can be accomplished by using less compliant components (i.e. replacing helical couplings with stiffer “bellows” couplings or substituting shorter and thicker shafts for longer and thinner ones. To stiffen belt drives, use wider or shorter belts, belts with steel banding, or parallel (multiple) belts. Installing stiffer gearboxes and stiffening the frame or base of the machine can also help reduce mechanical resonance problems.

VFDs

As mentioned earlier, VFD and motor applications may exhibit multiple resonant frequencies. In most of these cases, the solution for mechanical resonance problems is to program the VFD to “skip” the problem resonant frequencies. This prevents the motor from operating in speed ranges associated with resonance or vibration.



Load-to-motor inertia

Another way to attack mechanical resonance problems is to reduce the ratio of load-to-motor inertias. For example, when a motor is physically much smaller than the pump it drives, it will be harder to control than a larger motor; this will make it more susceptible to mechanical resonance. Using a motor with a larger physical size will improve the load-to-motor inertia ratio and therefore decrease resonance problems. (Of course, such a solution might not be practical, because it may require major modifications of the electrical and mechanical systems.)

Motor base modification

Modifying the motor base is another way to reduce mechanical system resonance. The motor manufacturer can usually supply the information needed to calculate the system resonant frequency of an installed motor: motor weight, centre of gravity and static deflection. Bases in typical installations are not truly stiff, so the actual resonant frequency of the system will probably be lower than calculations show. When this frequency is at or near operating speed,

it may be necessary to change the resonant (or critical) frequency of the motor to prevent an enormous increase in vibration amplitude.

Common ways to accomplish this include altering the stiffness of the base, modifying the weight of the motor/base combination, or changing (usually lowering) the centre of gravity (see Figure 2). (Note: In motors with sleeve bearings, a reed critical speed of about 40% to 50% of running speed can cause vibration due to oil whip or whirl.)

Electrical system resonance

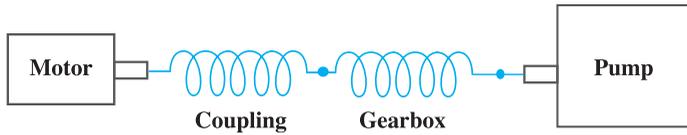
In addition to excitation of mechanical resonance, there is also the possibility of electrical power system resonance, often associated with the presence of harmonics.

The power supplied by the electric utility is normally a pure sine wave at the fundamental frequency, commonly 50 Hz or 60 Hz. Connecting non-linear loads to the power system, however, can inject undesirable frequency components called harmonics at multiples of the fundamental frequency. For example, a typical VFD produces these undesirable components at the 5th harmonic (five times the fundamental frequency), as well as at the 7th, 11th, 13th and so on. Examples of non-linear loads include personal computers, uninterruptible power supplies (UPSs) and DC motor drives.

As Figure 3 shows, adding harmonics to the fundamental frequency produces a distorted, non-sinusoidal waveform. Depending on the level of harmonic distortion, harmful effects can range from nuisance tripping and minor faults to damaged motors and pumps, and lengthy downtime. Harmonics also increase losses in the power system and electrical equipment.

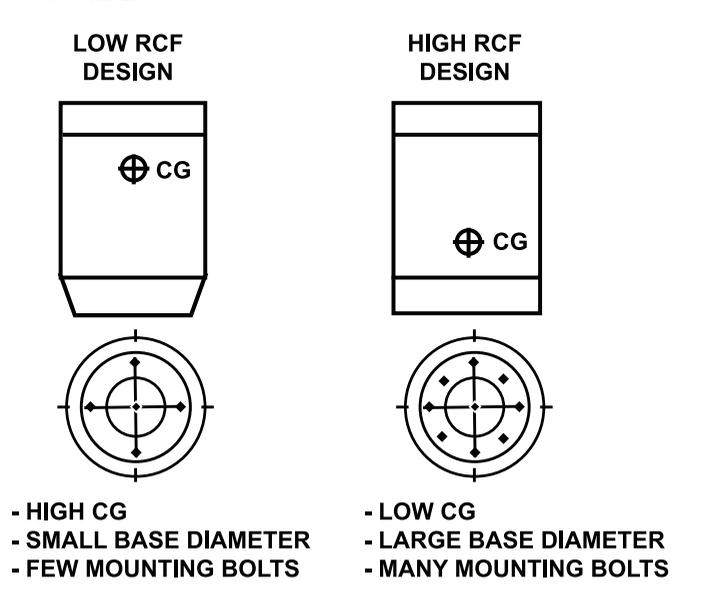
For motors, the higher-frequency harmonic components place additional electrical stress on windings, increase rotor heating and reduce motor life. Potentially the most detrimental effect of harmonics is they could excite a system resonance that damages motors and pumps or even causes system failure. Harmonics can also cause faulty meter

FIGURE 1



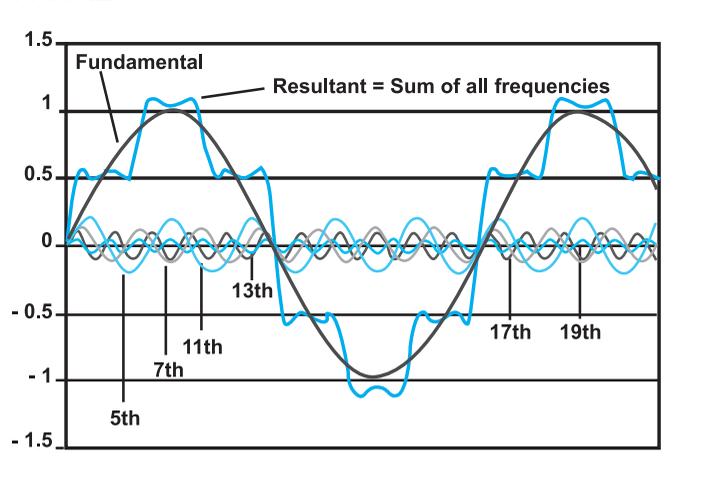
A motor and pump two-mass system connected by a series of "springs".

FIGURE 2



The effect of the centre of gravity (CG) and base diameter on the reed critical frequency (RCF).

FIGURE 3



Example of a highly distorted electrical waveform.

readings, motor bearing failure (due to electrical currents), blown fusing on power-factor-corrected systems, and telephone communication interference. Many of these problems may go undetected until the affected equipment fails.

When a VFD or other non-linear device injects a harmonic current at the resonant frequency, the system becomes excited or unstable. A variation of Ohms law ($V = IZ$) applies for system resonance. When I (amps) and Z (impedance) are high at the same time, V (voltage) becomes exceptionally high. This causes excessive heating or possibly immediate dielectric failure in capacitors, transformers or other devices.

Another issue is that most manufacturers of VFDs specify a maximum lead length between their equipment and the motor. This varies by manufacturer and drive, but typically ranges from 50 to 250 feet (15 to 75 metres). Because this restriction can make application difficult, impractical or even impossible, many VFD users disregard it, leading to more motor failures—and downtime.

When the resonant frequency of the lead conductors falls within the frequency range of the VFD voltage waveform, the conductors themselves will go into resonance. That will amplify the voltage components at (or near) the natural resonant frequency of the conductors, causing

voltage spikes that can exceed 2.5 times the DC bus voltage of the inverter section of the VFD.

Solutions for electrical system resonance and harmonics

The obvious solution for preventing voltage spikes in VFD systems is to keep the lead length between the motor and drive within the drive manufacturer's specifications. As mentioned earlier, VFDs also can be programmed to "skip" problem frequencies.

Commonly available solutions for reducing harmonics include line reactors, isolation transformers, filters and higher-pulse VFDs (i.e. 12- or 18-pulse). All have strengths and weaknesses that should be carefully considered to determine which is best for a particular installation.

The simplest and most common way to reduce harmonics is to add impedance to the system. This solution offers the largest reduction in total harmonic distortion relative to cost. In fact, increasing impedance by just 3% will reduce current harmonics by about 50% in a standard 6-pulse VFD. This solution is often accomplished at the VFD by installing a DC choke or input line reactor, an isolation transformer, or combination thereof.

Line reactors

Line reactors provide the impedance to reduce harmonic current but are smaller and usually cost less than isolation transformers. Also called inductors, they are available in standard impedance ranges of 1.5%, 3%, 5% and 7.5% of the load impedance.

Applying a line reactor at the drive terminals can help reduce the resonant frequency of the total circuit. But additional losses in the copper and core of the inductor increase overall circuit dampening. While this reduces the peak of the overshoot voltage (voltage spikes), it also increases its duration, thereby still resulting in additional stress on the motor windings.

Isolation transformers

An isolation transformer provides several advantages. First and foremost it provides impedance to the drive, which reduces current distortion. Properly selected, it can be used to match the supply voltage to the rated voltage of the load. When the secondary is grounded, it also isolates ground faults and reduces common mode noise (electrical noise that occurs simultaneously on all conductors of an electrical circuit).

Harmonic filters

Harmonic filters may also be installed, sometimes in combination with reactors and resistors, to reduce the harmonic content of the power system. In its simplest form, the capacitor-inductor combination "traps" or filters out the harmonic current of a single frequency. Low-pass filters are available with capacitors, inductors and resistors that allow only low frequencies to "pass" through them.

Applying a tuned, low-pass filter at the terminals of an inverter can remove all of the VFD carrier frequency voltages. These application-specific, custom filters were originally designed to limit audible motor noise. While this approach removes all VFD frequencies above the fundamental and affords excellent motor protection, the filters also reduce the fundamental voltage due to inductor losses. This may cause the motor to draw higher fundamental current to produce rated horsepower.

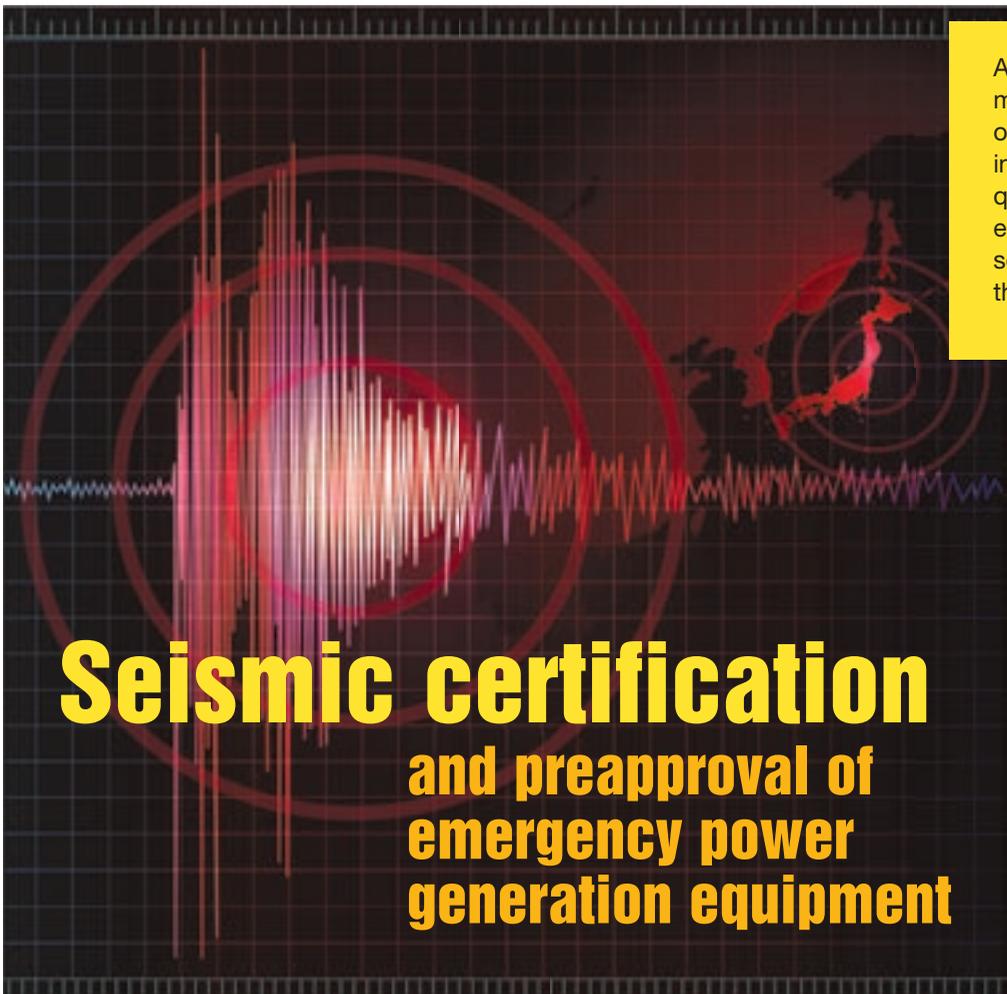
Conclusion

Whether resonance problems are mechanical, electrical or some combination of the two, early detection and correction are critical. Resonance problems not only degrade the efficiency of the motor-drive system through added losses, but they also may lead to equipment or system damage, as well as costly downtime and lost production. **EB**

Thomas H. Bishop, P.Eng, is a technical support specialist at the Electrical Apparatus Service Association (EASA, www.easa.com), an international trade association of more than 2100 firms in 58 countries that sell and service electrical, electronic and mechanical apparatus.

Although several months have passed since that massive earthquake and tsunami ruined a large chunk of Japan, those images of destruction are burned in our minds forever. Events like that also lead us to question the reliability and resiliency of our own built environment. So while the following paper focuses on seismic requirements in the State of California, we find the information valid for all of us.

— Editor



Seismic certification and preapproval of emergency power generation equipment

Aniruddha Natekar and George Williams

The State of California is famously susceptible to severe earthquakes. Less serious localized earthquakes occur frequently without much publicity, although they can do substantial damage in the immediate area. In response to this pervasive risk, the state legislature passed a series of laws starting in the 1970s to ensure that hospitals would be built to high construction standards and be capable of functioning—even after a major disaster.

In the 1980s the responsibility for reviewing all hospital construction plans for the State of California was moved to the Office of Statewide Health Planning and Development (OSHPD), and the Division of the State Architect. This legislation created a building department within the Office of Statewide Health Planning, called the Facilities Development Division (FDD).

In the 1990s, the legislature established a single point of accountability and authority for plan review and construction/observation activities relating to hospitals by transferring all duties and functions to FDD. As a result, the hospital design and construction industry had a single enforcement agency to provide all application services and technical guidance for health facility projects in California.

Today, FDD reviews construction plans for code compliance and certifies that buildings and critical life-safety equipment—including emergency standby power systems—meet the agency's strict standards for earthquake survivability.

The current OSHPD seismic standards, detailed in OSHPD's Code Application Notice CAN 2-1708A.5 (October 31, 2008), build on those previously established by the IBC (International Building Code, 2006 edition) and the CBC (California Building Code, 2007 edition). The CBC Chapter 1613A, on "Earthquake Loads," also specifies ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures as the basis for design.

CAN 2-1708A.5 says that "active parts or energized components shall be certified exclusively on the bases of approved shake table testing in accordance with Section 13.2.5, ASCE/SEI 7-05 or experience data in accordance with Section 13.2.6, ASCE/SEI 7-05, unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components".

Prior to the introduction of a preapproval process, proving that all of the critical equipment specified for each hospital installation met these stringent OSHPD codes required a substantial effort. In the case of power generation equipment, the units to be delivered often had to be physically tested on a shake table and the results documented in an application for certification before the equipment could be delivered to the site and installed. This was an expensive and time-consuming process for the building designers and equipment suppliers, and OSHPD's Facility Development Division's resources were strained by the numerous applications that were submitted.



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Hospital installation at Our Lady of the Lake (LOL) Hospital in Baton Rouge, La. This hospital installed one diesel genset and five gas gensets, plus transfer switches and paralleling switchgear. Diesel power provides the quick-starting capability that is required for emergency standby power. Lean-burn natural gas, on the other hand, complements the diesel capability, allowing for maximum power availability, thanks to the use of pipeline gas.



Representatives from Cummins Power Generation and Panache Engineering at the PEER (Pacific Earthquake Engineering Research) lab at the University of California Berkeley (July 2010). The group was shake-testing a 2000 kW, 35,000-lb generator set as part of the preapproval requirements.

This genset is placed upon the largest triaxial shake table in the United States.

OSP or OSHPD Special Seismic Certification Preapproval

To help resolve this problem, OSHPD instituted a process called Special Seismic Certification Preapproval, or OSP, for life-safety equipment in 2009. Manufacturers meeting the OSP standard can have equipment pre-approved and do not have to shake-test the actual units to be delivered. That means faster installation and commissioning, and lower costs to contractors and end users.

Rigorous OSP requirements

The requirements for preapproval under OSP are strict. For a product line with similar structural configurations, OSHPD allows three methods of qualification: mechanical testing, experience data or structural simulation analysis.

Mechanical testing requires the simulation of forces associated with a seismic event. This typically includes the use of a shake table and sensors to record the dynamic forces applied, as well as verification of the duration of the test. All alternative mounting configurations (i.e. wall mounted and floor mounted) must be tested for both units.

Historical experience data from a previous seismic event is acceptable, but difficult to obtain because, in most cases, insufficient information is available after the fact.

Structural simulation analysis can be submitted, but the parameters must be validated by mechanical testing of at least two units, typically the smallest and the largest in the product range. Assuming the similarity among the differently sized nodes of the product line can be demonstrated, a similarity matrix can be used to validate the interpolated units between the two test sizes.

All tests must be performed by an independent laboratory with ISO (International Standards Organization) accreditation, or conducted under the supervision of a California-licensed structural engineer. Alternatively, a California-licensed civil engineer or mechanical engineer can conduct the testing, as long as the results are evaluated and signed off by a licensed structural engineer.

OSHPD recommends that the equipment manufacturer, the facility owner (where relevant) and the licensed

engineer conducting the tests work with OSHPD in advance to agree on a test plan prior to any testing, thus ensuring that the OSP preapproval requirements will be met.

When testing is completed, an application for preapproval, a certification report summarizing the test results, and any engineering analysis and experience data must be submitted to OSHPD for review. **EB**

As a sales application engineer, Aniruddha Natekar provides technical recommendations on installations and engineering support to customers, assists the sales force with technical training, and supports technical seminars. George Williams has 25 years of experience in the power industry, including serving as an instructor at EGSA (Electrical Generating Systems Association). His professional credentials include Journeyman Line Technician certification from IBEW and a Master Electrician license. Williams is an associate member of IEEE Power Engineering Society/IAEI Northwest Chapter. This article is based on a Cummins Power Generation White Paper, "Power topic #9012". Visit www.cumminspower.com.



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Standard Products complete HID lamp and ballast kit



Standard Products introduced a lamp and ballast kit that promises a convenient way to update HID systems. To eliminate guesswork, the kit is specifically designed with you in mind, says

the company; all required components—lamp, prewired ballast, capacitor, ignitor (when required), mounting brackets and hardware—are all packed together. Lamps should always be replaced at the same time as any of the other components in the fixture, says Standard, to ensure the system performs at its best. This practice also eliminates the need to re-service the fixture for the duration of the lamp's life cycle. The HID lamp and ballast kits are available in a variety of different lamp options including: probe-start metal halide (MH), pulse-start MH, and high-pressure sodium (HPS).

STANDARD PRODUCTS

www.standardpro.com

American Ballast launches HBF line



American Ballast has developed a series of high lumen, multi-voltage and energy-efficient ballasts. The High Ballast Factor (HBF) ballast line

provides energy costs savings in a wide range of applications, it claims, including retrofit installations or new constructions. With a 1.18 Ballast Factor, the series enables retrofits of a 4-lamp T12 fixture into a 3- or 2-lamp T8 fixture and can be used in high bay fluorescent fixtures, it adds.

AMERICAN BALLAST

www.americanballast.com

Juno AccuLite Finia Series Outdoor LED Luminaries

Juno Lighting Group, a subsidiary of Schneider Electric, has launched its series of high performance AccuLite Finia Series Outdoor LED Luminaries, which can be pole-mounted, wall-mounted or mounted as a flood light in commercial applications. Each series includes a high performance configuration with maximum fixture efficacy as well as a more economical version for the budget-conscious project, says Juno Lighting. Additional features include: two, three, or four LED modules depending on the light output/wattage selection; an IP65 full fixture rating; and options for integral emergency lighting, integral motion detection (with high/low switching) and dimming.



JUNO LIGHTING GROUP

www.junolightinggroup.com

Thomas & Betts All-Struct Quick Pole Assembly



All-Struct, a brandname of Thomas & Betts, now offers a Quick Pole Assembly, which it claims makes maintaining a wide range of equipment in hard-to-reach places safer and more efficient. Designed for hazardous location lighting fixtures, sirens, beacons, security equipment and more, the Quick Pole Assembly turns maintenance into a one-man job and eliminates the need for ladders, lifts or safety harnesses, it says. CSA-certified, the pole assembly is available in hot-dipped galvanized steel, aluminum and epoxy-coated finishes.

THOMAS & BETTS

www.tnb.ca

Lighting Science Group LED bulb line on Amazon.com



Lighting Science Group says it will bring low cost, high output LED lighting to more households and

businesses by offering the first in a series of high quality LED products on Amazon.com, one of America's largest online retailers. The company claims its new 40-watt equivalent A19 omnidirectional 8.5 watt LED bulb is 75% more efficient than the typical incandescent bulb it replaces and can last up to 23 years. Consumers will also soon be able to buy a 60 watt equivalent version, as well as BR, MR and PAR LED bulb types on Amazon.com.

LIGHTING SCIENCE GROUP

www.lsgc.com

Cathode Lighting Systems debuts CLS-Slim at Lightfair 2011

Cathode Lighting Systems debuted its latest innovation, CLS-Slim, during Lightfair International 2011, explaining that it has modified the design of its most popular fixture to only 1 5/8" wide and 2 3/8" tall



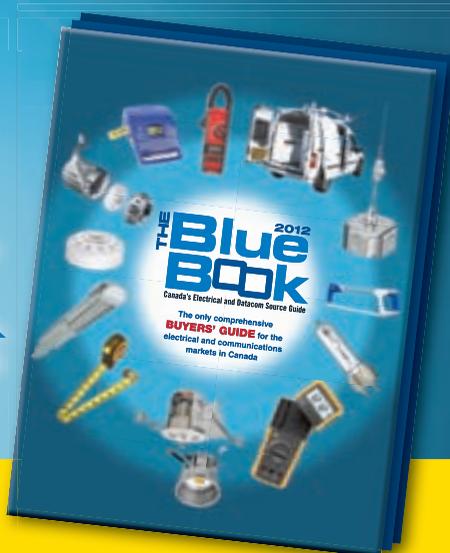
and achieving the smallest footprint of any cold-cathode luminaire available in the market today. Integral electronic ballasts offer a power factor >.95 along with standard integral 1% dimming ballasts. Other features of the cUL and UL Listed luminaire include: eleven different shades of white from 1900oK Candlelight to 8300oK Daylight; and wattages as low as 5.5 watts per linear foot.

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Dual-Lite PGR Remote-Only LED Emergency Sconce

Dual-Lite, a Hubbell Lighting Inc. brand, has launched the PGR High Performance LED Remote expanding its emergency lighting



portfolio. This low profile sconce is illuminated by four, high power 4000K LED's arranged so that in the event of one or two LED failures the unit will continue to operate, it explains. Other features of the remote include: a design optimizing wide area illumination patterns; no heads to aim; die-cast aluminum construction; and 90-minute emergency operation from external 6 through 12VDC source. It is available in four powder coat finishes: dark bronze, white, platinum, silver, and black.

DUAL-LITE

www.dual-lite.com

Illumra releases CMR, new light pole control solution

Illumra has launched the CMR, a new light pole control solution which it claims will work with any Dawn/Dusk sensor to reduce energy consumption by 50% by shutting off lights during the second half of every night. It can

also automatically synchronize with existing dawn/dusk sensors, adapt



to changing seasons, and limit peak demand inrush through sequenced start up, Illumra adds.

ILLUMRA

www.illumra.com

Standard Products unveils FlexLED retrofit series

Standard says its premium FlexLED retrofit series offers superior luminosity, exceptional thermal management and a high CRI (colour rendering index) for vibrant colours. The LEDs promise energy savings up to 89%, and up to 95% savings in maintenance costs. LEDs are environmentally safe (no mercury) and emit no UV. FlexLEDs are dimmable and available in an array of shapes (MR16, PAR20, PAR30LN and PAR38), colour temperatures of 3000 K, 4000 K and 5000 K, and in wattages of 4 to 18. The retrofit series is RoHS and FCC compliant, and cUL listed, with lamp life up to 50,000 hours.

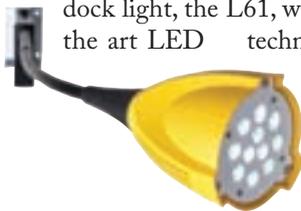
STANDARD PRODUCTS

www.standardpro.com



Lind Equipment releases L61 Led Dock Light

Lind Equipment has introduced its new LED dock light, the L61, which uses "state of the art LED technology to provide a high efficiency, low operating cost model that is bright enough



to light up an entire 53' trailer", it claims. The light uses 16W of power and according to Lind, the combination of low energy usage and the no-need to re-lamp means savings of up to \$125 per year per light. It is built with a flexible arm, and can be repositioned to accommodate the work environment.

LIND EQUIPMENT

www.lindequipment.net

Holophane offers Hazardous Wallpack IV Luminaires for harsh environments



Holophane says its new Hazardous Wallpack IV luminaires are designed to meet perimeter and security lighting requirements in a range of harsh environments. The luminaires include

a borosilicate glass refractor for precise light control, which it says translates into fewer luminaires required to achieve specified light levels. The company has also extended the UL listing to include hazardous Class I, Division 2, making the fixtures suitable for petro-chemical, water and wastewater, pulp and paper, and power generation plants.

HOLOPHANE

www.holophane.com

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Arlington recessed plastic combo boxes (TVB712 and TVB713)

Arlington says the angled openings on its new recessed, non-metallic boxes (TVB712 and TVB713) “take convenience to a new level” by keeping plugs behind the wall surface, while allowing for the use of the new close-clearance TV mounting hardware. According to Arlington, the TVB713 has power

and low voltage openings for video, audio and other datacom connections. It includes a separate interchangeable tray that holds the digital converter box supplied by some cable providers and hides it behind the TV. The TVB712 has openings for power and/or low voltage.

ARLINGTON
www.aifittings.com

Fluke P3 Series thermal imagers



Fluke claims its P3 Series thermal imagers are rugged, fast, affordable, and create the sharpest images in the industry for easy inspection and diagnostics. The P3 Series includes the Ti32 and TiR32 models, plus the new Ti27 and Ti29 models for industrial, electrical, mechanical, and process applications; and TiR27 and TiR29 models for building inspection, energy audit, weatherization, and building maintenance applications.

FLUKE
www.flukecanada.ca

Rittal Wallmount app hits iTunes Store

Calling it an ‘industry first’, Rittal describes its new Wallmount app as a quick selection tool, cross-reference guide and distributor locator all rolled into one convenient package. In less than 30 seconds, Rittal says users can find the part number for the next wallmount enclosure, location of the nearest distributor, and place a call to inquire about availability.



RITTAL
www.rittal.ca

Hilti SFC-A CPC Compact Cordless Drill Driver

Hilti says it has unveiled the world’s first compact cordless drill that is tough enough for a two-year wear-and-tear warranty, featuring 100% all-metal gears for longer tool life and greater reliability. The SFC 18-A CPC Compact Cordless Drill Driver weighs 3.7 lbs and delivers 1,800 RPM in second gear. Casings for the batteries and tools are glass-fiber reinforced and protected by rubber sections, giving them the ability to withstand hard, every day jobsite use, says Hilti.



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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



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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.

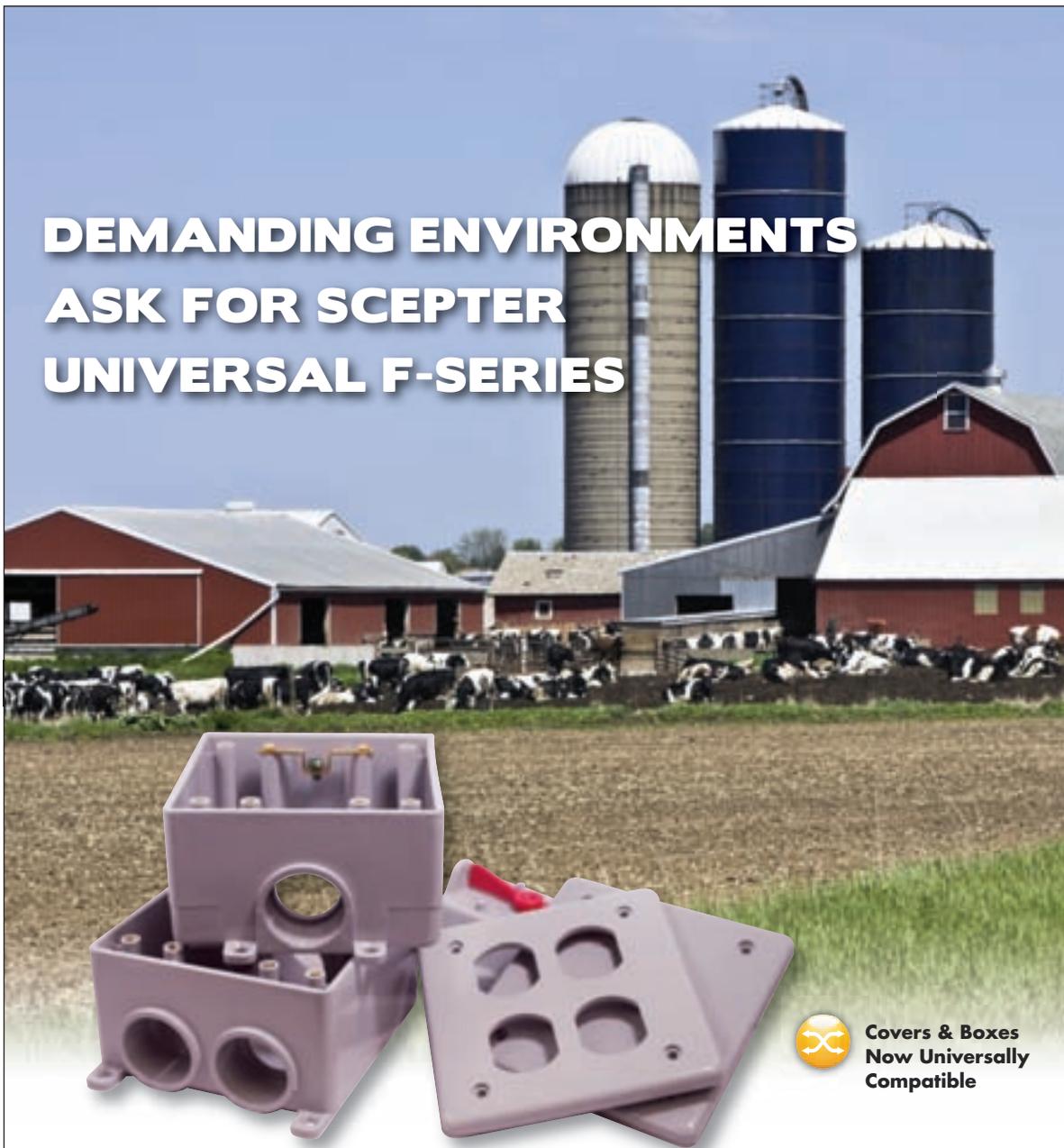
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Wago offers 2706 Series PCB Terminal Strips

Wago Corporation claims its new 2706 Series PCB Terminal Strips bring lever-operated terminations to compact electrical applications. Ranging from 2–12 poles, the 2706 Series provides a lever for each pole. Lifting each opens a Cage

Clamp Spring Pressure unit that remains open for “conveniently terminating multi-conductor cables into the terminal strip,” Wago adds. Pin spacing ranges from 7.5, 10 to 12.5mm — the 12.5mm variant achieves UL 600V certification.

WAGO
www.wago.us

Nuheat unveils the new dual-voltage Harmony thermostat



Nuheat has announced that the “best-selling” Harmony thermostat is now dual-voltage. Now available, the Harmony—exclusively manufactured for Nuheat by Honeywell—is a single thermostat compatible with both 120V& 240V floor heating systems. The 7-day programmable thermostat continues to boast of its designer inspired aesthetics, mounting flush into a standard double-gang electrical receptacle (behind any decora-style faceplate).

NUHEAT
www.nuheat.com

Greenlee LS50L Battery-Powered Knockout Punch Driver

Greenlee, a Textron Inc. company, has designed a new Battery-Powered Knockout Punch Driver, which it claims is capable of punching up to 6-inch conduit holes in 14-gauge mild steel or up to 2-inch in 14-gauge stainless steel. The new LS50L is part of the Greenlee series battery tool platform with 18V lithium-ion battery power and was developed for residential, commercial and industrial contractors. The available smart chargers control the charging current, charging voltage and battery temperature to maximize battery life.



GREENLEE
www.greenlee.com

Ridgid SeeSnake CS-10 Digital Monitor

Ridgid has unveiled the new rugged SeeSnake CS-10 digital monitor for simple one-touch, full-feature digital recording. The one-touch feature enables the CS-10 digital monitor to record still images and video. The monitor features video and image playback and the exclusive auto-log recording method, which compresses files to help save memory on the USB thumb drive, where digital inspections are stored.



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Electrical equipment vaults

The Canadian Electrical Code defines a “vault” as “an isolated enclosure either above or below grade with fire-resisting walls, ceilings and floors for the purpose of housing transformers and other electrical equipment”. This article discusses the CEC requirements for electrical equipment vaults designed to house flammable liquid-filled equipment.

Rule 26-012 of the CEC specifies that when installed indoors, transformers and other equipment containing more than 23 litres of flammable liquid in one tank or 69 litres in a group of tanks must be located in an electrical equipment vault.

Rules 26-350 to 26-356 provide some clarification and overall requirement for electrical equipment vaults as follows:

- When used, the word “vault” means “electrical equipment vault”. In this article, I will use the word “vault”.
- Vaults must not be used for storage and must be of sufficient size to meet CEC clearances from electrical equipment.
- Vaults must be constructed in accordance with the requirements of the National Building Code of Canada.
- Adequate lighting and receptacles must be provided.

The National Building Code of Canada specifies the requirements for construction of vaults

containing flammable liquid-filled equipment in buildings. Vaults must be constructed of solid masonry or concrete having a fire resistance rating of at least 3 hours. Fire resistance rating may be reduced to 2 hours if the vault is equipped with a fire extinguishing system.

When a building is required to be sprinklered, a vault within the building doesn't need to be sprinklered if the vault contains only electrical equipment, and a smoke detector in the vault actuates the building fire alarm system in the event of a fire in the vault.

Vaults must have reinforced concrete roofs or ceilings and floors minimum 150 mm thick. Floors at excavation level may be a minimum 100 mm thick. Walls, ceilings and floors must be anchored together so that no damage will result due to an explosion. The floor must be liquid-tight and the electrical equipment surrounded by sills of sufficient height so as to contain all of the flammable liquid, with a minimum height of 100 mm. A floor drain must be installed to drain any liquid spillage to a closed sump of sufficient size to contain all of the flammable liquid.

Vaults must have ventilation systems to prevent the ambient temperature from exceeding 40°C. When natural ventilation is provided from outdoors, the total areas of wall inlet and outlet openings must be at least .002 square mm per kVA of the equipment contained

in the vault. In the case of power transformers, the ventilation requirements may be based on the full load losses of the transformers. When electrical equipment is used exclusively for emergency backup and is not normally energized, ventilation of the equipment need not be considered for design of the ventilation system.

When a vault is ventilated by outdoor air, the bottom of the fresh air inlet must be at least 1000 mm above the floor level in the vault. Screens over ventilation openings must be fastened so that they cannot be removed from outside the vault.

When mechanical ventilation is provided, it must be separate from the building's ventilation system and:

- The temperature in the vault is thermostatically controlled;
- The ventilation fan is located so that it can be serviced without any danger to servicing personnel;
- A high temperature alarm is provided and controls to shut off the ventilation system in case of a fire in the vault; and
- The fresh outside air inlet is filtered if necessary.

As with previous articles, you should always consult with the electrical inspection authority in your province or territory for a more precise interpretation of any of the above. **EB**

Les Stoch is president of L. Stoch & Associates, specialists in quality management/engineering services. He is a member of PEO, OEL and IAEL, 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.



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

Tackle The Code Conundrum... if you dare

Answers to this month's questions in September'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

If receptacles are mounted in a trailer park in a vertical position, the CEC requires the U-ground slot to be:

- a) At the top
- b) At the bottom

Question 2

For a mobile home, the minimum permitted size conductor for the power supply cord is:

- a) #10 AWG c) #6 AWG
- b) #8 AWG d) #4 AWG

Question 3

What is the maximum length of 12-trade size liquid-tight flexible conduit permitted for the connection of equipment?

- a) 600 mm c) 1.0 m
- b) 750 mm d) 1.5 m

Answers to Code Conundrum EBMag June/July 2011

Q-1: Where receptacles of type 14-50R are installed on recreational vehicle lots, the CEC requires them to be protected by GFCI of Class A type.

b) False.

Q-2: Does the CEC allow the usage of non-metallic sheathed cable in a building of combustible construction?

a) True.

Q-3: For receptacles having CSA configurations 5-15R or 5-20R installed in buildings under construction, they:

d) All of the above.

There is a ton of news and updates at the newly renovated EBMag.com. And be sure to follow our Tweets on Twitter (twitter.com/ebmag) to find out whenever there's something new on our website.



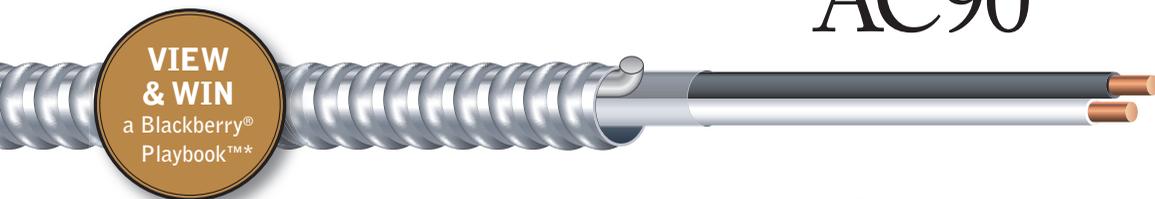


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