

# Electrical Business

OCTOBER 2011



## What is apprenticeship... and why should we use it?

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### Also in this issue...

- Standardized parts for your fleet
- Understanding LED fixture lifetime
- U. Laval's new fire protection system

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Isn't it great when we see concrete examples of your efforts coming to fruition?

## Proof that generosity works

We are often asked to participate in, or contribute to, various foundations, charities, etc., and we answer the call to action because—despite our complaints—we know we've got it pretty good here in Canada. A lot of times we answer the call on faith alone, so isn't it great when we see concrete examples of your efforts coming to fruition?

At last year's Independent Electrical Distributors annual meeting, Craig Kielburger spoke about Free the Children and building schools (See "From the editor" in EBMag August 2010). By the end of that meeting, 23 schools were donated by IED and the family of distributors, suppliers and individuals and, recently, I received the following updates, which I want to share with you here... again, because it's rewarding to see your generosity making a difference.

Photo 1 shows the opening ceremony at Dos Palais, Haiti. They have seven school blocks, all of which are constructed of anti-seismic materials. The Dos Palais school was built from scratch, and 12 more school blocks are planned to accommodate future growth.

Schools are also being built in Kenya. Photo 2 shows the old classroom in Mwangaza, while Photo 3 shows the foundation being dug for the one. Photo 4 shows the finished school block in Sikirar, Kenya (what all classrooms in Kenya look like when completed).

Finally, Photo 5 shows a school built in Aluo, China, which opened this March to 245 students in Grades 1 through 6.

Congratulations to you all. **EB**

*Anthony Caplan*



PHOTO 1



PHOTO 2



PHOTO 3



PHOTO 4



PHOTO 5



On the cover and page 12

### What is apprenticeship... and why should we use it?

Yes, we know... you've heard this before. But "Apprenticeship Pays" isn't just a slogan, it's a fact. Across Canada, employers just like you have told us that hiring apprentices has been a key to their success.

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Fleet managers are under pressure to reduce maintenance costs, so when your fleet faces vehicle replacement, it's the perfect opportunity to standardize, which can significantly reduce future operating costs.

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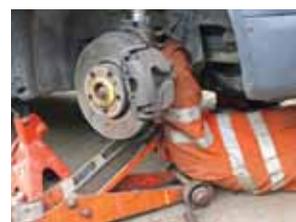
As with key photometric measurements, life calculations for LED light sources and conventional light sources differ considerably. What's needed is a method for making accurate comparisons between conventional lamps and LED lighting fixtures.

### 28 Playing it safe with digital multimeters

When it comes to electrical safety, voltage spikes are an unavoidable hazard. As such, it is important for anyone working on electrical circuits to understand the best combination of tools and procedures to ensure their safety.

### 30 Université Laval receives high marks in fire protection

CASE STUDY: A few years ago, Université Laval invested in a new, code-compliant and standardized fire protection network spanning its 32 buildings campus-wide, as the old fire alarm systems were an aging conglomeration of different makes and models. The job involved replacing every alarm panel, detector and supervisory device.



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**EBMag's Prize Winners from Nedco Electrifest 2011**

A big thanks from Electrical Business to everyone who stopped by our booth at Nedco Electrifest 2011 to say hello. If you were there, you'll remember we had a random draw for some awesome prizes from our friends at Milwaukee ([www.milwaukeetool.com](http://www.milwaukeetool.com)). Here are the winners:

- The M12 cordless Li-ion 3/8-in. hammer drill driver (2411-22) went to **Jason Swatek**, an electrician/engineering technologist with **HDC Electrical Services**.
  - The M18 cordless Li-ion right angle drill went to **Veljko Vincic** of **Demarcation Point**, a **BICSI** member.
  - Finally, the brand new 5/8-in. SDS Plus rotary hammer went to **Ahest Ikohomi**, the owner of **Ikoh Electric**.
- Thanks to all, and see you in three years for the next installment of Nedco Electrifest.



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**SAIT's Trades and Technology Complex receives Gold Seal Project designation**

SAIT Polytechnic (<http://sait.ca>) campus recently celebrated the designation of the school's new Trades and Technology Complex as a Gold Seal Project, making it the first educational facility in Alberta to receive the distinction, it said. The Calgary Construction Association (CCA, [www.cca.cc](http://www.cca.cc)) partnered with SAIT and PCL Construction Management for the project, and representatives from each party were present at the ceremony.

"The CCA is thrilled with the dedication from the PCL management team to embrace the national Gold Seal Program and strive for construction excellence," said CCA president Jim Clement.

Barry Brown, past chairman of the CCA and current chairman of the National Gold Seal Committee; Irene Lewis, president and CEO of SAIT Polytechnic; Rob Otway, district manager, PCL Construction Management ([www.pcl.com](http://www.pcl.com)); and Clement represented the four partners as they signed a Memorandum of Understanding (MOU) indicating the objectives of the Gold Seal Project which outline a commitment to "promote Gold Seal Certification in construction management, demonstrate excellence in construction management and showcase professionalism and enhance the image of the construction industry".

"The Gold Seal designation for the new Trades and Technology Complex is a mark of pride for SAIT, for PCL and the construction industry," said Lewis. "We look forward to teaching our students the art and science of construction in this spectacular new complex, which, itself, has been built to the highest standards".

Following the signing of the MOU, 20 individuals were presented with Gold Seal Certificates, and a \$25,000 cheque presentation to SAIT for new tools and equipment for the complex.

**New business name for Dow Wire & Cable**

Dow Wire & Cable ([www.dow.com/electrical](http://www.dow.com/electrical)) has officially changed its business name to Dow Electrical & Telecommunications to better reflect its offering to electrical and telecom markets, it said.

"This is an important step for a business already focused on power and telecommunications cable technology to further fortify its commitment to bring material science solutions to these industries and markets that no other business or company

can do in the world," said the company.

"Electricity and electrical components are a common denominator across all power and telecommunications resources. After six decades serving these important markets, the time is right to leverage the Dow portfolio in an even wider capacity to bring new technology and products to market," continued Tim Laughlin, company general manager. "Beyond this organic growth, we also are exploring several potential alliances with companies whose products and experience enhance

or complement our own".

The Dow Chemical Company has an R&D and materials science heritage which it describes as "rich in solutions enabled by plastics, composites, additives and fluids".

"Combining these assets with Dow Electrical & Telecommunications knowledge and expertise, along with those of other strategic partners, creates a significant opportunity to bring even more value to the growing and dynamic power and telecommunications markets," it added.

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**National Electrical Safety Code 2012 published**

IEEE has launched its new National Electrical Safety Code (NESC) – 2012 Edition (<http://standards.ieee.org/about/nesc>), which it claims to provide practical guidance to help safeguard employees and the public when electrical supply and communications lines are installed, operated and maintained, including overhead and underground electrical supply lines, telephone or cable and TV lines,

and signal and power installations for railroads.

“The NESC continues to be the industry standard in the electrical industry and communications utility field,” said Michael Hyland, chair, NESC committee and senior VP of Engineering Services for the American Public Power Association (APPA). “We are happy to have had the opportunity to take part in this project and are very pleased with its final outcome”.

Revisions in the 2012 edition include:

- Scope, application and definition rules extensively revised to provide clarification improvements, particularly with respect to whether the NESC or the National Electrical Code (NEC) (NFPA 70) applies in certain situations.
- Grounding rules added specificity to the methods to be used to help achieve effective grounding connections.
- Electrical supply stations rules added options for improved protection of energized parts from interference by activities outside the stations and for guarding inside the stations. The overhead general rules revised requirements for inspections and for facilities to be grounded or insulated.
- Underground rules revised the inspection rules and clarified requirements for direct-buried cables and conduits not part of a conduit system.
- Work rules added options for determining appropriate arc ratings for apparel to be worn while working on energized lines, including a new Section on Clothing requirements for <1000 Volts and added maximum clearing times allowed for specified apparel arc ratings.
- Revised the minimum approach distances (MADs) to meet the requirements of IEEE 516TM-2009, and revised specification for the location of employee protective grounds.

The NESC covers different topics including storage batteries, transformers and conductors to switchgear, circuit breakers, physical clearances, cable terminations, safety warning signs, and protective clothing for workers installing electrical equipment. For example, its clearance rules outline the minimum distances between electric transmission wires and the ground, and structures such as buildings and trees.

“As the trusted steward for the NESC standardization process, the IEEE Standards Association (<http://standards.ieee.org>) plays a vital role in helping to improve the safety of electricity supply workers and the public by publishing the Code,” said Judith Gorman, managing director, IEEE-SA. “Today the Code is used throughout the U.S. and in more than 100 countries, and we are proud of our ongoing commitment to maintain the NESC as it executes its rigorous process that results in consistent high quality and reputation throughout the industry”.



# A strong heritage of innovation

In 2011, Eaton celebrates its 100th anniversary and a heritage of innovation and expertise that has positioned the company to answer some of the world's toughest power management challenges.

This spirit of innovation and entrepreneurship driven by integrity and an unwavering commitment to ethics was part of Joseph Eaton's vision when he founded the company. Since that time, Eaton has evolved from a leader and innovator in vehicle technologies to a leading global power management company that also serves the hydraulics, aerospace and electrical markets. Our proven technologies and products play an important role in managing power in many things that impact our daily lives – from more energy-efficient buildings,

cities and infrastructure to next-generation aircraft, cars, trucks and machines.

Today, Eaton's global operations serve diverse markets and customers in more than 150 countries. As we help customers to use energy more reliably, efficiently and safely, our values and strong culture of “doing business right” will continue to guide us toward building a more powerful tomorrow.

Learn more at [Eaton.com/heritage](http://Eaton.com/heritage).



**Despite protesters, Durham York Energy Centre breaks ground**

“The Regional Municipality of Durham has been working toward a long-term waste management solution since 1999, and we’ve found an answer in the Durham York Energy Centre,” said Anderson. “Now that construction is about to commence, I expect the facility to be fully operational by the end of 2014”.

The EFW process also includes production of high-pressure steam, which is fed through a turbine generator that produces electricity. When operating at design capacity, the electricity sold to the provincial grid is sufficient to power about 10,000 homes, while the future district heating system will produce heat equivalent to the needs of 2200 homes.

“Covanta is excited to be a part of this tremendous partnership with the Regions of Durham and York,” said Anthony J. Orlando, president and CEO of Covanta Energy. “Bringing complex infrastructure projects like this to fruition takes strong leadership and courage of conviction to challenge the status quo. The Regions’ should be applauded for their vision and efforts to bring this project to reality”.

The Durham York Energy Centre will have a maximum capacity of 140,000 tonnes per year. The Region of Durham is entitled to process up to 110,000 tonnes each year, while York Region is entitled to process up to 30,000 tonnes annually.

“Today’s groundbreaking signals the start of construction of the first energy-from-waste facility built in Ontario in 22 years,” said Fisch. “York and Durham Regions are committed to the diversion of residual waste from landfill and thermal treatment of waste is smart technology to achieve our goals”.

Funding for this project was made possible by the federal Gas Tax Fund, which “provides municipalities with a source of stable and predictable funding for environmentally sustainable infrastructure, while also helping to stimulate economic development, create new jobs, and improve infrastructure to support economic growth and long-term prosperity”. Visit <http://t.co/BoyIWdM> for our exclusive VIDEO.



Photos A. Capkun



Despite delays caused by anti-incineration protesters, EBMag was there to cover the official groundbreaking ceremony for the new Durham York Energy Centre (DYEC, [www.durhamyorkwaste.ca](http://www.durhamyorkwaste.ca)), which is located in the Municipality of Clarington (Ontario) in a huge site slated to be the Clarington Business Park.

“We’re finally ready to put the shovel in the ground!” beamed Durham regional chair and CEO Roger Anderson, who was also the primary target of protesters’ insults. Speaking to concerns protesters have over pollution, Anderson said, “We [council] have our skin in the game... We live here. Our kids live here”.

He added that the new DYEC will meet the toughest emissions standards in the world. Meantime, York Region chair and CEO Bill Fisch explained that when the new facility comes online, about “90% to 95% of residual waste from York and Durham Regions will not go into landfill”.

The DYEC promises to be a state-of-the-art, energy-from-waste (EFW) facility. It will process the residential waste that remains after Durham and York Regions’ “aggressive and highly successful composting and recycling programs” while recovering materials and energy. Through thermal mass burn technology, the municipal solid waste is fed into a furnace where it is burned at temperatures above 1000°C. The remaining ash is then shipped to landfill or reused in product manufacturing.

✉ **Major disconnect between motor manufacturers and utilities**



I read with some interest the article on voltage unbalance and motors in your June/July issue. Motor manufacturers want the voltage to be within 1%, which would be nice except they

do not check with the utilities supplying the power who only try to maintain it to within 2% (and at that only 95% of the time based on long-time averages). I’ve also had energy professionals say the same thing.

Clearly, there is a major disconnect here.

Although, when you look at the derating chart, you can go to a 3% unbalance if you derate the motor to 91% so, if you follow good practice of only loading motors to 80% of full load, you should be okay. Unless, of course, the load has crept up and you are loading it closer to the limit.

And, if you are an industrial plant with almost exclusively 3-phase motor loads, there is not a lot you can do to balance the small portion of single-phase loads from lighting, office equipment and so on. It’s even more problematic if you have single-phase process heating loads that are controlled by SCRs that are dancing around all the time.

Good article, though, in covering the basics and what is behind it all.

See Hydro Quebec’s document (page 16) at <http://bit.ly/oivXEa> (other utilities are similar). **EB**

*James B. Montreal, Que.*

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**Ford, Toyota to collaborate on new hybrid system for light trucks and SUVs**

Ford and Toyota have teamed up to develop an “advanced new hybrid system” for light truck and SUV customers and have signed a memorandum of understanding (MOU) on the product development collaboration, with the formal agreement expected by next year, they said.

The two automakers say this new hybrid powertrain will bring the full hybrid experience



Derrick Kuzak, Ford group VP Global Product Development and Takeshi Uchiyamada, Toyota executive VP R&D, sign a Memorandum of Understanding to collaborate on a new rear-wheel-drive hybrid system for light trucks and SUVs, and to collaborate on the development of next-generation standards for in-car telematics. (Photo Sam VarnHagen/Ford Motor Co.)

of greater fuel efficiency to a new group of truck and SUV customers without compromising the capability they require in their vehicles. Ford and Toyota believe their collaboration will allow them to bring these hybrid technologies to customers sooner and more affordably than either company could have accomplished alone.

“This agreement brings together the capability of two global leaders in hybrid vehicles and hybrid technology to develop a better solution more quickly and affordably for our customers,” said Derrick Kuzak, Ford (www.ford.ca) group vice president, Global Product Development. “Ford achieved a breakthrough with the Ford Fusion Hybrid, and we intend to do this again for a new group of truck and SUV buyers—customers we know very well”.

Takeshi Uchiyamada, Toyota (www.toyota.ca) executive vice president, Research & Development, said: “In 1997, we launched the first-generation Prius, the world’s first mass-produced gasoline-electric hybrid. Since then, we have sold about 3.3 million hybrid vehicles. We expect to create exciting technologies that benefit society with Ford – and we can do so through the experience the two companies have in hybrid technology”.

The two companies have also agreed to

work together on enablers to complement each company’s existing telematics platform standards, helping bring more Internet-based services and useful information to consumers globally, they said.

Under the MOU agreement, the two companies will “bring the best of their independently developed hybrid powertrain technology and knowledge to a new co-developed hybrid system, which will be used in rear-wheel-drive light trucks arriving later this decade”.

“By working together, we will be able to serve our customers with the very best affordable, advanced powertrains, delivering even better fuel economy,” said Ford president and CEO Alan Mulally. “This is the kind of collaborative effort that is required to address the big global challenges of energy independence and environmental sustainability”.

This rear-wheel-drive hybrid system will be based on an all-new architecture to deliver the capability truck and SUV customers demand while providing greater fuel economy, they added. Next on the agenda, the automakers are set to collaborate on developing next-generation standards for in-car telematics and internet-based services.

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**Grainger acquiring shares of Fabory Group**

Grainger (www.grainger.com) has announced its intention to acquire the shares of Fabory Group (www.fabory.com), a European distributor of fasteners and related MRO products. The transaction price will be about \$344 million.

The parties said they plan to enter a definitive agreement upon completion of required consultations with Works Councils representing Fabory employees in the Netherlands, Belgium and France. The transaction is subject to customary closing conditions and is expected to be completed in the third quarter of 2011.

With 2010 sales of about \$300 million, Fabory offers its 120,000 customers access to more than 80,000 products in 14 countries, said Grainger, adding that the



Netherlands-based company has been aggressively expanding its MRO and fastener offering throughout Central and Eastern Europe and also provides supply chain fastener solutions to OEM customers in Europe, North America and China as well as through a joint venture in India through Sterling Fabory Ltd.

Grainger said it intends Fabory to continue as a separate busi-

ness maintaining the Fabory name and brand. Oswald van den Belt, chief executive officer of Fabory Group, will continue to lead the business and report to Court Carruthers, senior vice president and president, Grainger International.

Based in Canada, Carruthers oversees all of Grainger’s international businesses, including the largest, Acklands-Grainger in Canada. **EB**

**Alcan Cable** ([www.cable.alcan.com](http://www.cable.alcan.com)) has named **Jean Courteau** as national sales manager, Distribution for Alcan Cable in Canada, where he will lead the Canadian distribution business team to work with the company's rep agencies to service customers in and throughout the distribution channel in Canada. Courteau has more than 12 years of experience with the company, most recently as senior engineer, distributor products Canada & International, where he was involved in codes & standards work. Prior to that, he held an international position in the start-up of a new business venture in China. Courteau is a graduate of Concordia University, holds an MBA from McGill University, and is a member of the Order of Engineers of Quebec (OIQ).



Jeff Krakowiak

**Jeff Krakowiak**, vice president and general manager, Eaton's Electrical Sector—Americas Region, has announced the appointment of **Richard Jackson** to the position of manager, Canadian Regional Satellites and the Mississauga Operations (formerly **CopperLogic**), effective November 1. Eaton's eight Canadian satellite locations specialize in customized electrical distribution and control assemblies/solutions for the Canadian market, said the company, adding that Jackson will have direct accountability for these locations, as well as the former CopperLogic operation in Mississauga. Jackson has held different roles within CopperLogic, including director of sales and operations, as well as director of supply chain. He holds a Bachelor of Commerce degree from Ryerson University and an MBA from Athabasca University.



Richard Jackson

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David Wylie

**Liteline** ([www.liteline.com](http://www.liteline.com)) has named its newest team member: **David Wylie**, a specification sales representative for Southern Ontario where he will apply his 22 years of

lighting industry experience in support of A-Line and Liteline lighting products, said the company. According to Liteline, his experience ranges from roles in national accounts, sales management and marketing, as well as specification sales. "David has played

a pioneering role in many positions and projects over his career and his expertise will ultimately benefit the customers of Liteline," it added.

**Lumenpulse Inc.** ([www.lumenpulse.com](http://www.lumenpulse.com)) has announced that **Chris Christiani** has joined as vice-president of manufacturing and operations, where he will oversee the company's manufacturing and supply chain functions, with a "focus on quality and operational efficiencies". He brings 30 years of experience

to the company, including more than 10 years in solid-state lighting.

**Lighting Science Group** ([www.lsgc.com](http://www.lsgc.com)) has appointed its CEO, **James "Jim" Haworth**, to its board of directors to serve as chair. "Jim brings immense experience, insight and vision to the table, and that's exactly what Lighting Science Group needs," said Rich Weinberg, former chair and current vice-chair and director. **EB**

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# How do you win at telephone tag? Don't play!

*Tag (also known as it, tig, tiggy, tips, dooby, chasey, tick) is a game played worldwide that involves one or more players chasing other players in an attempt to tag or touch them, usually with their hands. There are many variations. Most forms have no teams, scores, or equipment.*

— Wikipedia



The benefits are huge and nobody loses out:

1. You are empowering the receptionist.
2. You are giving more authority to your people.
3. You are giving your customer a faster response.
4. You are saving yourself a lot of time.

Too many of us allow the telephone process to make us feel important. I think it is ridiculous when I hear men taking phone calls while in the washroom (is nothing sacred?), or see people texting while walking down the street.

Recent studies show that banning the use of cell phones while driving (with the exception of hands-free) is backfiring; rather than respect the ban, a lot of drivers are merely trying harder to hide the fact they are still using their cell phones (or, worse, texting) while driving, thereby creating drivers who are an even greater danger.

### The Takeaways

- Identify the amount of time you spend playing telephone tag.
- Identify the amount of time that you deal with trivia during this process.
- Put a process in place to minimize the negative impacts and create the advantages stated above. **EB**

I remember playing telephone tag with a client a few years ago. After the first couple of rounds, I kept it going just to prove a point.

I would phone and ask for Mark. The reply would be, "He's not here; I will get him to phone you back". When he returned the call, I was out. We went around in this circle for four days. I even got to the stage that, when I saw his name on call display, I wouldn't answer.

On Day Five, I said to his receptionist, "Ask Mark if he would like to go for lunch on Thursday or Friday". Two hours later, there was a message on my voice mail: "Friday would be best".

The significance of this story is two-fold. First of all, I didn't need to speak to him on the phone and, secondly, no one was managing the process. There was a lot of time wasted in setting up that lunch.

### Do you play telephone tag?

I ask my contractors how incoming calls are handled when they are not in the office. Invariably, I get one of two replies: either the call is put through to voice mail, or the caller is given a cell number.

Neither of these two methods should be the initial response. A much more powerful way of dealing with this is for the receptionist to say, "Ron isn't available right now. Is there any way I can help you?"

This is yet another opportunity to delegate; to empower someone, like your receptionist, to make a decision. The receptionist can triage the call and either take a message that she can discuss with you later, or pass the call on to someone else in your organization who can handle the caller's issue.



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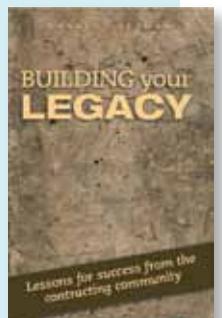
  
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Ron Coleman, a member of the Institute of Certified Management Consultants of British Columbia, just published his latest book, "Building Your Legacy: Lessons for Success from the Contracting Community", which teaches you how to make more money while 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](http://www.ronaldcoleman.ca).





Dave Smith

mind your safety **EB**

## Entering indoor substations Part five

(At the end of Part 4 "Entering outdoor substations" last month, Dave explained the danger of induction, and the importance of distancing yourself from equipment when you see anyone preparing to operate a switch.)

The first four articles in this series concentrated on outdoor substations. Now we move indoors.

Moving from the outdoors to an indoor substation is like moving from one world to another; the same dangers exist, but they're packaged differently. When you are walking toward the door of an outdoor substation building, look for damage to its exterior. Explosions split the corners of buildings, wind and storms wreak damage, workers could be on the roof... what you want to see is a building with no apparent damage or danger.

Look in the window and check to see if there is anything out of place, or whether workers are inside. Feel the door and the glass with the back of your hand to sense if there's any heat.

When you grab the door handle, hang on carefully and tightly so you have control. There have been instances where substations have been brought down because, on a windy day, an uncontrolled door swung inward, hitting equipment hard enough to cause the electro-mechanical relays to trigger. This won't happen when you're inside a building, but outside—where it can be windy—this is just one more safe work practice.

Once you're inside, stop! Don't move. Use your senses! Smell for any burning smells caused by the overheating of insulation, dust, dirt, etc. Also smell for anything that can be described as extremely fresh air, similar to what occurs after thunderstorms. It is caused by corona that occurs at medium voltages and is extremely damaging to insulation. Corona also reveals itself as a very faint blue glow; inspecting your equipment through your viewing windows with your substation lights turned off may reveal it. It has to be pitch black, and it takes a few moments for your eyes to adjust, so be patient.

Corona also sends out a broad spectrum of ultrasonic sounds; these can be detected by hand-held instruments specifically designed for this and other purposes; one of these should be standard equipment in a substation.

If you are on a 'beans-and-wieners' budget, a portable transistor radio set off-station can also detect corona. A radio can be used to detect any electrical arcing, so the next time you are trying to find an intermittent short or open, grab a radio.

Intently listen for any sounds that may be abnormal, especially a sound like bacon sizzling; if it is steady, you have a major problem requiring immediate attention. If you hear a very short sizzle or a pop, it can be the advent of insulation failure and this will repeat many hours later; the time between discharges will get shorter and shorter as the problem worsens.

Many companies conduct infrared surveys assuming they are comprehensive tests but,

in fact, they are specific to heat dissipation from poor connections. Corona-damaged insulation will not be detected with infrared surveys, and your detection will be an explosion or, if you are lucky, your protective system shutting part or all of your facility down.

Every machine has a rhythm, and a substation is no different. Good mechanics and operators know the sounds of their machinery and buildings. Learn the sound signature of your substation. People say to me "Our substation is quiet as a church". That may be, but there are still sounds of operation.

The truth is, our senses are deadened here in North America: our eyes are overwhelmed with too much to see; our ears tuned only to primary sounds while blocking chatter and other pollutants; our noses reserved for shallow breathing and fine motor skills refined by very few.

At this moment there is a native in the mountain forests of New Guinea standing stock still, centred within a 360° bubble, smelling upwind, listening in all directions, feeling the ground for vibrations and carefully watching; his entire radar system is focused on detecting every possible danger, patiently waiting until he is sure his next actions are safe.

Retiring uninjured is a challenging task for all of us, especially for industrial workers. Learn to move through your days patiently, using your senses as actively as every bushman throughout the world.

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](mailto:davesmith@canada-training-group.ca). At [www.canada-training-group.ca](http://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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# What is apprenticeship... and why should we use it?

## “Apprenticeship pays.”

**Y**es, we know... you’ve heard this before. But “Apprenticeship Pays” isn’t just a slogan, it’s a fact. And it’s not us talking; it’s employers across Canada who are just like you; employers who have told us that hiring apprentices has been a key to their success.

Here’s the thing: when you own or manage a small- or medium-sized company that requires skilled tradespersons, chances are you’ve been finding it more difficult than before to hire skilled workers.

It’s not your imagination. There is a shortage of skilled trade workers in Canada, and it’s getting worse as baby boomers retire and fewer young people are available to take their places.

So where will you get the talent you need to complete the jobs you have in-house or to ramp up for future projects?

1. Do you stop looking and hope you can manage with the staff you have?
2. Do you take on someone who may not have the skills you need and hope they work out?
3. Do you hire an apprentice and train them to your own requirements?

We recommend Option #3. Hire and train an apprentice. It’s the best way to create the certified professionals you need to sustain and grow your business.

What’s more, the returns are outstanding. The employers we talk to experience an average revenue of \$1.47 for every dollar they invest in apprentice training. That’s almost a 50% return! And our studies show it’s getting better every year.

But here’s a surprise: employers tell us this payback begins even before the apprentice period is over. It seems that bringing motivated, techno-savvy young people on staff can energize your whole workforce, improving their productivity and your bottom line.



And the best part is this: when you develop skilled workers to grow your business, you also help keep your trade growing and adapting to industry needs. That's good for all of us, and it's great for Canada's future. You may be a small business, but you can make a huge difference.

### Apprenticeship at a glance

#### What is apprenticeship?

1. Apprenticeship is post-secondary education, like university or college, that helps people learn a particular trade by combining technical training instruction with on-the-job training.
2. Depending on the trade, an apprenticeship period will range from two to five years.
3. When it's over, the apprentice can obtain full journeyman status.

#### How does it work?

4. You hire an apprentice. Someone who wants to earn while they learn a skilled trade, for two to five years (depending on the occupation).
5. You provide structured, supervised on-the-job training. The apprentice learns hands-on by working directly under the supervision of a skilled journeyman in your workplace (80% of the program).
6. Your apprentice participates in related technical training (20% of the program).
7. Your apprentice earns credentials. By successfully completing the training and instruction, and the required assessments, your apprentice will achieve official journeyman status with a recognized Certificate of Qualification (his ticket) that is issued by your provincial or territorial apprenticeship authority.

#### Who pays for it?

8. You pay the apprentice's wages. While your apprentice trains on the job, you pay them an hourly wage. This begins as a portion of the trained rate of pay for the occupation, and increases as they

complete each level of the program.

9. The apprentice may pay for his tuition. He may also be required to pay for books and tools.

#### Who's in charge?

10. Apprenticeship is government-regulated but industry-driven. To ensure provincial/territorial trade standards, the industry defines the content of both training and instruction. Specific provincial/territorial regulations establish the length of on-the-job training, the type and amount of related technical training instruction, and the supervision of the apprentice.
11. You and your apprentice sign a contract. Apprenticeship begins with a signed legal agreement between you (the employer), the apprentice, and the province/territory. This agreement specifies the length of training, the technical training instruction required, the skills to be learned, and the wages the apprentice will receive.

### Why should I train an apprentice?

Because it's an investment in your company—with *excellent returns!* In 2008, CAF-FCA surveyed 1000 employers from 16 trades in every region across Canada. Many of those with apprenticeship programs consider it a key to their success. Their top reason? It can ensure a sustainable supply of skilled workers trained to their own needs. Apprenticeship can give your company the same competitive edge. Here are 8 Benefits for your Business:

#### 1. It makes your company more productive

Naturally, a person who is properly trained is more productive than one who is not. But it's also true that a journeyman you train internally will be more productive than one you hire from outside. In the beginning, an apprentice can do basic things that help the rest of your team work more efficiently. As they gain skills and knowledge, they also develop a thorough understanding of your business needs and how best to meet

them. Gradually, they become highly trained professionals who perform at peak efficiency to maximize your productivity.

#### 2. Improves your product quality

Through hands-on training and classroom instruction, apprentices get to really understand their trade and its tools. They learn to maintain equipment properly and use material appropriately, ensuring a quality product, less waste, and longer life for your valuable equipment. The whole experience instills a sense of pride that can increase the overall standard of quality in the shop.

#### 3. Enhances the skills of all your staff

Apprentices are keen to learn and their enthusiasm is contagious. Journeymen who train them will enhance and revitalize their own skills and knowledge. And, during classroom instruction, apprentices learn the latest technology and best practices, which they can pass on to all of your staff. This two-way skills development can inspire others to continually improve.

#### 4. Improves health and safety

A journeyman who teaches and monitors safety procedures for an apprentice is likely to become more rigorous about safe work practices throughout the shop. This can lead to fewer mistakes and accidents, lower compensation costs, and lower insurance costs, as insurance companies recognize the lower risk of a skilled workforce.

#### 5. Reduces employee turnover and costs

A person who wants to serve an apprenticeship is one who is willing to make a commitment to a career and to your company. Studies show that employees who are properly trained tend to work for the same employer longer and take fewer sick days—especially when they see themselves in a career, *not just a job*. People in careers are more motivated and have more job satisfaction, so they are more likely to stay put. Which is good, because employee

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#### **But will it work for *my* company?**

The overwhelming evidence says Yes, it will. Our survey of 1000 employers in 16 trades shows that training pays off for all sizes of business, right across Canada. We know you still have questions. The following 7 Facts for your Peace of Mind should help you rest easy:

##### *1. What if my journeyperson doesn't want to train an apprentice?*

**FACT:** Employers say journeypersons jump at the chance. According to those we talk to, many journeypersons say training an apprentice gives them a new lease on life. They enjoy passing on their wisdom while simultaneously refreshing their own skills and knowledge. They especially like it when apprentices share the latest tools and techniques they learn at school. Even those journeypersons who were reluctant at first become enthusiastic and committed.

##### *2. I can't believe our productivity won't suffer.*

**FACT:** Studies show that apprentices make you *more* productive, not less. Apprentices are motivated and their energy is contagious. And, when they're looking over your shoulders, your workforce is more conscious of doing things right, like keeping the shop clean and safe, maintaining equipment, and using tools and materials properly. Thanks to apprentices, many employers say they have decreased their unit cost through less waste, fewer mistakes and fewer warranty returns.

##### *3. I can't afford to pay an apprentice.*

**FACT:** Apprentice wages are a sound investment with outstanding returns. They start as a portion of a trained employee's wage, and grow as the apprentice becomes more valuable to you. Along the way they are more than paid for by the returns you gain from higher productivity and lower turnover. You can also apply for available tax credits.

##### *4. Our shop is slow right now; I don't have enough work for an apprentice.*

**FACT:** If you train them, it will come. Business goes up and down for all of us. But if you wait until you need someone and hire at the last minute, skilled workers can be harder to find and cost more to hire. You may be forced to take on people who aren't suitable. So instead of thinking job to job, look ahead to the skills you will need in the future, and hire an apprentice now to make sure you have them.

##### *5. I don't have the time to administer this.*

**FACT:** Managing an apprenticeship is not complex or time-consuming. Your local apprenticeship branch may provide a structured training program with up-to-date learning materials, including step-by-step task lists for your journeyperson and apprentice to follow.

##### *6. What if the apprentice doesn't fit in?*

**FACT:** They're more likely to fit in than someone you hire from outside. In fact, employers tell us that "better fit with the organization" is one of the best results of training an apprentice. That's because the on-the-job training will effectively tailor the apprentice to your corporate culture. Under the wing of your journeyperson, they will learn your systems and processes, gain the skills your business needs, understand the industry you work in, and inherit the values and standards of your company. Chances are your apprentices will do more than fit in—they will become the mainstay of your business.

##### *7. What if my trained apprentice gets poached?*

**FACT:** Studies show that apprentices stay longer than workers you hire from outside. When you train apprentices, they appreciate the investment you've made and tend to stick around, especially when they can *envision a career* and not just a job. They will be more interested, more motivated and more loyal. And, if they do eventually leave, you still don't lose; remember, the revenues that an apprentice generates begin to exceed costs before their apprenticeship period is over.

turnover costs can be many times the *leaver's* annual wage in terms of lost expertise and productivity, decreased staff morale, training time and materials, lower customer service... even loss of customers.

##### *6. Provides a competitive edge*

Hiring an energetic and techno-savvy young person can give your shop a real leg up when it comes to competing for customers and contracts (especially valuable when you're a smaller company). Young people embrace technology, and they're exposed to the latest innovations during technical training instruction that could be valuable to your business. Having this special insight in your workforce can lay the foundation for a competitive edge that attracts excellent employees—and customers.

##### *7. Makes you more profitable*

Our ongoing Return on Training Investment (ROTI) research shows that employer costs (in terms of apprentice wages, administration and journeyperson's time) are more than offset by increased revenue from higher productivity, knowledge of the latest technology, higher customer satisfaction, and the ability to take on more jobs. The net benefit is quite astounding. Our latest survey shows that, by the end of Year 4, each \$1.00 invested returned an average of a \$1.47: that's almost a 50% return!

Our research also shows that revenues start exceeding costs even before they finish training—generally by the end of Year 2! Training pays out for all sizes of business, right across Canada. And this payout grows as the apprentice becomes a highly trained employee who makes a real contribution to your bottom line.

##### *8. Lets you plan a successful future*

The end result of your apprenticeship program is also the best benefit. While others struggle to find skilled workers, you will have

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## What could I gain from training an apprentice?

Which of these statements resonates with you and your staff? Use the left-hand column to number them in order of importance, then use the right-hand column for questions or comments to discuss.

### Our business needs to...

Be more productive	
Improve our product quality	
Enhance the skills of all staff	
Improve health and safety	
Increase employee retention and reduce turnover costs	
Gain a competitive edge that attracts talent and customers	
Be more profitable	
Plan a successful future	
Provide career opportunities in our area	
Other?	

### Why haven't we done it before?

What has stopped you from hiring an apprentice? Number the reasons in order of relevance. Then check out the facts in the right-hand column.

Our Excuses	The Facts
Our journeyman won't want to train an apprentice.	Most enjoy sharing their skills and learning new ones.
Our productivity will suffer.	An apprentice will make us more productive, not less.
We can't afford to pay an apprentice.	We will gain a lot more than we pay out.
We don't have enough work for an apprentice.	If we train them, it will come.
We don't have the time to administer this.	Everything's organized for us, including training materials.
An apprentice won't fit in.	They're more likely to fit in than someone we hire from outside.
Once trained, our apprentice will get poached by another company.	Apprentices stay longer than workers hired from outside.

### Okay, so who does what?

An apprenticeship is a partnership between you (the employer), your apprentice, and your provincial or territorial apprenticeship authority—three partners with equal commitment.

#### 1. You (the employer) will:

- Hire and register your apprentice. Contact your local apprenticeship authority office and sign an agreement with the apprentice that outlines the responsibilities of all parties throughout the apprenticeship period.
- Give your apprentice a safe place to work that encourages learning, with proper equipment and shop facilities.
- Provide your apprentice with the required skills training in your workplace—supervised by a certified journeyman—and work with the apprentice to successfully complete it.
- Pay your apprentice a fair hourly wage while they train on-the-job, usually set at a rising percentage of the journeyman's wage.
- Give your apprentice time off work to complete the related instruction at each stage of the program.
- Keep accurate records of on-the-job training (hours and type of work) and update your apprentice's log book.
- Keep in touch with your local apprenticeship authority, and notify them when there are any changes or developments that could affect the apprenticeship program.

#### 2. Your apprentice will:

- Commit to a period of on-the-job and technical training.
- Actively participate in and successfully complete the required on-the-job training to learn and perfect specified skills.
- Attend technical training, and may pay for tuition.
- Manage his time, keep work records and keep track of his progress, including the hours and skill sets required to complete the apprenticeship.
- Provide honest and loyal service, showing due regard for your property.
- Obey all lawful orders given by you or any person you designate.
- Work safely, not just for his own sake but for the sake of his co-workers.

#### 3. Your apprenticeship authority will:

- Work with industry to develop and maintain occupational definitions, training and certification standards.
- Designate and authorize training institutions to deliver the technical training.
- Help schedule training (in most provinces and territories).
- Monitor and verify record books for your apprentices and qualified journeymen, and issue certificates.
- Conduct assessments.
- Keep you and your apprentices informed about the system.

Remember, it's not just a catchy slogan: Apprenticeship *does* pay... just ask us. **EB**

*This article is based on the paper "Apprenticeship Pays... Just Ask Us", published by the Canadian Apprenticeship Forum/Forum canadien sur l'apprentissage (CAF-FCA, [www.caf-fca.org](http://www.caf-fca.org)), and funded by the Government of Canada's Sector Council. CAF is an inclusive national body that brings together all players in apprenticeship training. Mark June 3-5, 2012, on your calendar, as that's CAF's next large conference, "Apprenticeship: Strategies for Success", in Regina, Sask.*

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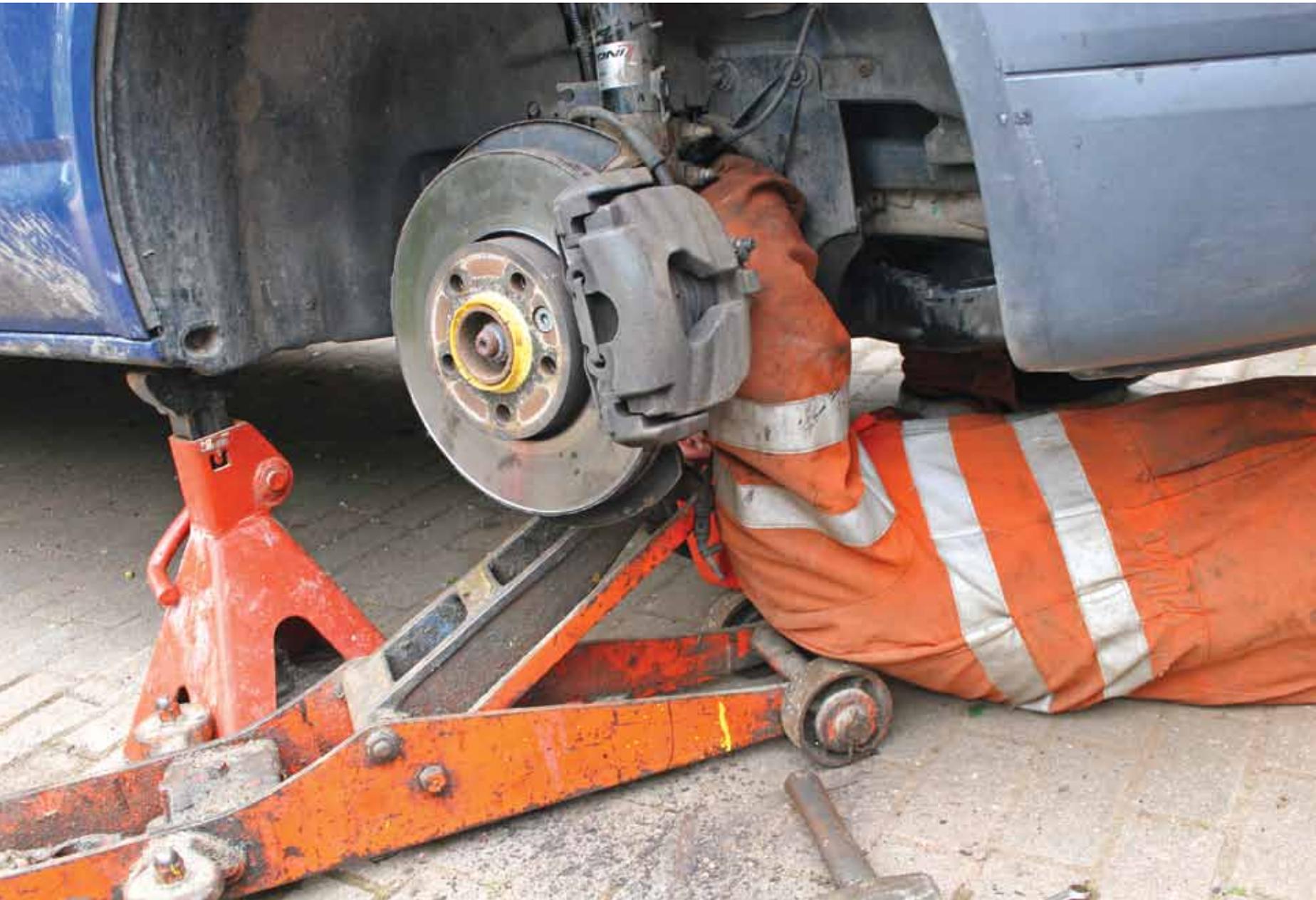


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# The common goal of standardized parts



## Align your work truck fleet maintenance and save time and money

Bob Johnson

**M**ost fleet managers are under pressure to reduce maintenance costs, but aside from deferring maintenance altogether, options are limited. However, every fleet faces vehicle replacement. So, when this occurs, you will have the opportunity to standardize your fleet, which can significantly reduce future operating costs.

### But I can't standardize my fleet!

Many fleets operate under restrictions that may limit their ability to become fully standardized. This is especially true for government fleets and those with a purchasing organization that bases buying decisions solely on lowest cost. Nonetheless, even with these conditions, there are still many opportunities for standardization.

Very few fleets can completely standardize their operations. The ideal standardized fleet would be composed almost exclusively of a limited number of vehicle types, all purchased from the same OEM. Since the opportunity to build such a uniform fleet is a rare occurrence, a fleet manager should ask the following question: "What can I do to standardize in my specific situation?"

### Standardization opportunities

Limit the makeup of your fleet to as few OEMs as possible, and as few models from each OEM as possible. Since this is easier said than done, you may have to look harder for other standardization opportunities, which will likely be found in specific chassis components. For example:

1. When purchasing medium- and heavy-duty trucks, specify common components, such as air compressors, brake slack adjusters, alternators and bypass oil filters. In addition, you may be able to standardize on foundation component manufacturers, such as engines, transmissions and axles.
2. When specifying truck bodies, standardize with a single manufacturer for all of your lighting components. Also, minimize the number of different part numbers used. Even if the selected supplier changes its lighting components, the company will likely keep the same mounting systems and wiring connectors so that you can upgrade your lighting and still maintain standardization.



The downside of standardization is that if you make a poor product selection, you may have a big problem. Be sure to review your maintenance records and talk with your mechanics before making a component selection.

3. Identify all of the accessory components you use, such as generators, under-deck air compressors, snow and ice control equipment, welders, specialty hydraulic control systems, winches and more. Standardize on a single manufacturer for each type of component, even if you are purchasing multiple models.
4. Standardize your shop tools and test equipment.

#### How does standardization save money?

A key benefit of standardization is reduced maintenance parts inventory costs. However, there are more opportunities in other areas, as follows:

- 1. Reduced technician training costs**  
As truck systems become more sophisticated, the need for training increases. Even with multiple models, as long as you are dealing with a single vendor, chances are good that many of the various component models will employ the same basic technology. In addition, when you have standardized with a single supplier, the company will likely provide free or discounted training. Also, fewer systems means less unproductive training time for your mechanics.
- 2. Reduced costs for test equipment**  
Fewer different systems may reduce your diagnostic hardware and/or software purchasing needs.
- 3. Faster failure diagnosis**  
No system or component is perfect, so failures are inevitable. When you standardize with a specific system, your mechanic may be able to identify the problem just by reading the operator's trouble ticket or performing a quick hands-on test. This drastically reduces diagnostic time and increases your shop's productivity.
- 4. Faster repair times following diagnosis**  
Again, as your mechanics become more familiar with your equipment, repair times decrease. Increased productivity resulting from equipment familiarity is one of the biggest sources of savings associated with vehicle standardization.
- 5. Lower component and repair parts acquisition costs**  
Standardization means higher volumes for both new component purchasing and repair parts. When your fleet is large enough, you may be able to negotiate special pricing from the component supplier. You can then either purchase the components yourself and consign them to an upfitter when purchasing new trucks, or specify that the upfitter use your special pricing and pass the savings on to you. On the repair parts side, larger volume give you greater leverage in negotiating contract prices for parts with your suppliers.

**6. Accident reduction**  
Don't forget that as you standardize your equipment, your mechanics and end-users will no longer need to switch between various makes and models of vehicles and/or equipment on a daily basis. This increased familiarity can result in significant reductions in on-the-job accidents.

**7. Do your homework**  
The downside of standardization is that, if you make a poor product selection, you may have a big problem. Be sure to review your maintenance records and talk with your mechanics before making a component selection. In the case of end-user components, make sure your customers are satisfied with your tentative selections. Regarding specialty components, verify the financial health of the tentative supplier. You don't want to end up with a fleet of orphan equipment because the supplier has gone out of business.

**8. Selling the idea**  
In many cases, fleet managers will likely have to sell the idea of pursuing a standardization strategy to other groups (i.e. purchasing departments and, in the case of government fleets, political oversight boards). Before approaching these groups, develop a detailed plan that maintains the maximum level of competitiveness while at the same time providing your fleet with a viable financial benefit. Every fleet and situation will be different, so take your time and build your case first. When properly approached, standardization is a battle you can win. **EB**

*Bob Johnson is the fleet relations director for the National Truck Equipment Association (NTEA, [www.ntea.com](http://www.ntea.com)), which produces The Work Truck Show, North America's largest annual tradeshow dedicated to Class 1-8 vocational trucks and equipment. For more information, contact Bob at [bobj@ntea.com](mailto:bobj@ntea.com) on how NTEA can benefit your company.*

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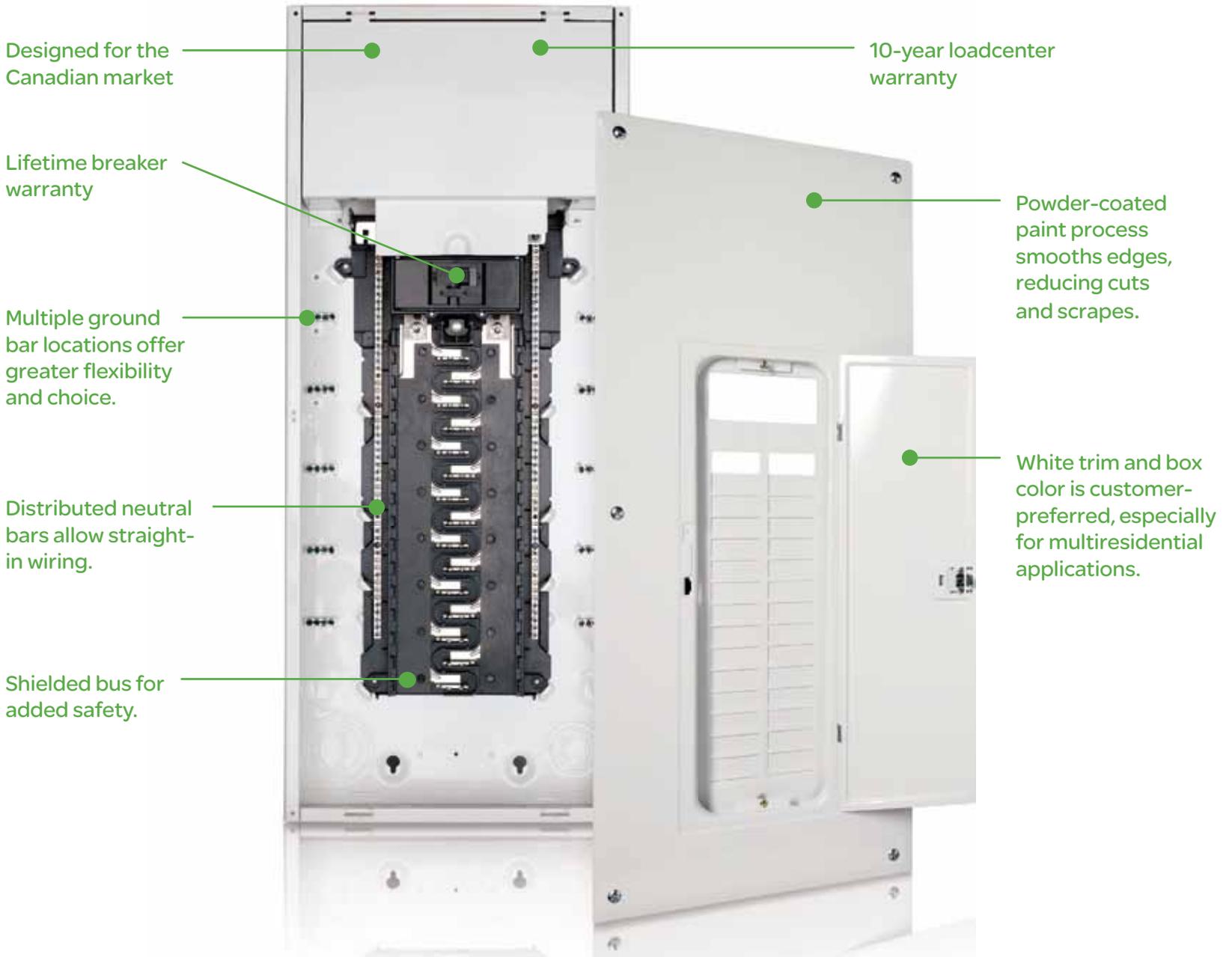
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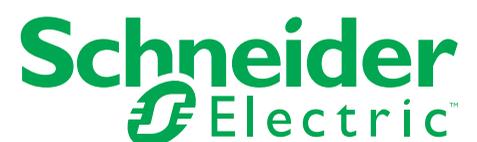
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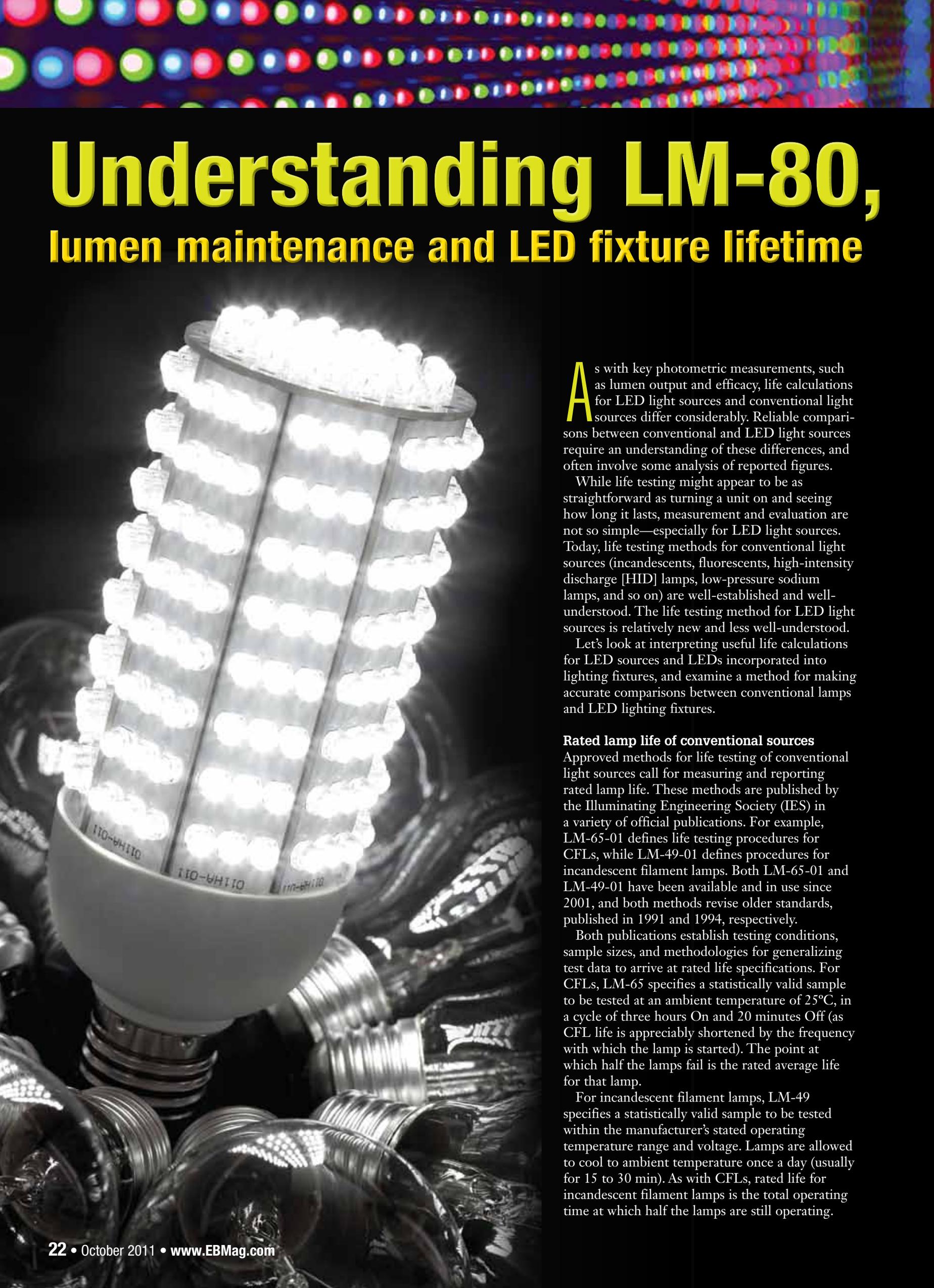


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# Understanding LM-80, lumen maintenance and LED fixture lifetime

As with key photometric measurements, such as lumen output and efficacy, life calculations for LED light sources and conventional light sources differ considerably. Reliable comparisons between conventional and LED light sources require an understanding of these differences, and often involve some analysis of reported figures.

While life testing might appear to be as straightforward as turning a unit on and seeing how long it lasts, measurement and evaluation are not so simple—especially for LED light sources. Today, life testing methods for conventional light sources (incandescents, fluorescents, high-intensity discharge [HID] lamps, low-pressure sodium lamps, and so on) are well-established and well-understood. The life testing method for LED light sources is relatively new and less well-understood.

Let's look at interpreting useful life calculations for LED sources and LEDs incorporated into lighting fixtures, and examine a method for making accurate comparisons between conventional lamps and LED lighting fixtures.

## Rated lamp life of conventional sources

Approved methods for life testing of conventional light sources call for measuring and reporting rated lamp life. These methods are published by the Illuminating Engineering Society (IES) in a variety of official publications. For example, LM-65-01 defines life testing procedures for CFLs, while LM-49-01 defines procedures for incandescent filament lamps. Both LM-65-01 and LM-49-01 have been available and in use since 2001, and both methods revise older standards, published in 1991 and 1994, respectively.

Both publications establish testing conditions, sample sizes, and methodologies for generalizing test data to arrive at rated life specifications. For CFLs, LM-65 specifies a statistically valid sample to be tested at an ambient temperature of 25°C, in a cycle of three hours On and 20 minutes Off (as CFL life is appreciably shortened by the frequency with which the lamp is started). The point at which half the lamps fail is the rated average life for that lamp.

For incandescent filament lamps, LM-49 specifies a statistically valid sample to be tested within the manufacturer's stated operating temperature range and voltage. Lamps are allowed to cool to ambient temperature once a day (usually for 15 to 30 min). As with CFLs, rated life for incandescent filament lamps is the total operating time at which half the lamps are still operating.

### Lumen maintenance and lumen depreciation

In September 2008, IES published LM-80-08, "Measuring Lumen Maintenance of LED Light Sources" as a counterpart of LM-65, LM-49 and other life testing standards for conventional light sources. However, it differs from the older standards in a number of important—and potentially confusing—ways.

Instead of measuring rated lamp life, LM-80 calls for measuring how much an LED source's lumen output decreases over a certain number of hours of operation. Technically, the term for this decrease is *lumen depreciation*. The converse of lumen depreciation is lumen maintenance, the industry-standard term for the percentage of initial lumens that a light source maintains over a certain period.

All electric light sources lose lumen output over time; indeed, annexes to both LM-65 and LM-49 address lumen depreciation of CFLs and incandescent filament lamps. In incandescents, lumen depreciation is caused by depletion of the filament and the build-up of evaporated tungsten particles inside the bulb. Incandescents typically lose 10% to 15% of their initial lumen output over an average life of 1000 hours. In fluorescent lamps, lumen depreciation is caused by photochemical degradation of the phosphor coating and glass tube, and the build-up of light-absorbing deposits inside the tube. High-quality fluorescent lamps using rare earth phosphors lose only 5% to 10% of initial lumens over 20,000 hours of operation. CFLs depreciate more, but the most well-designed products lose no more than 20% of their initial lumens over an average life of 10,000 hours.

In LED sources, factors that cause lumen depreciation include drive current and heat generated within the device itself (technically speaking, at the diode's p-n junction), which degrades the diode material. Some white-light LEDs may experience degradation of the phosphor coating like that of fluorescent lamps. Some can also lose lumen output due to clouding of, or impurities in, the encapsulant used to cover LED chips.

*Lumen maintenance* measurements take the form  $L_p$ , where  $L$  is the initial output of a light source, and  $p$  is the percentage maintained by the light source over a certain number of hours.  $L_{97}$  measures how long a light source retains 97% (or loses 3%) of its initial output,  $L_{44}$  measures how long a light source retains 44% (or

loses 56%) of its initial output, and so on.

Since high-performance LED light sources can produce useful light for tens of thousands of hours—and since they rarely fail outright—lumen maintenance is often used in place of rated life measurements for LEDs. Measuring the rated life of LED light sources (the mean time to failure of a representative sample) would require operating the sources

continually until they finally faded to darkness—a process that would take many years. Because LED light sources continue to deliver light even after their initial lumen output has decreased by 50% or more, lighting specifiers and designers need to know how long an LED lighting fixture will retain a meaningful percentage of its initial light output—not how long it will take for the light sources to fail.

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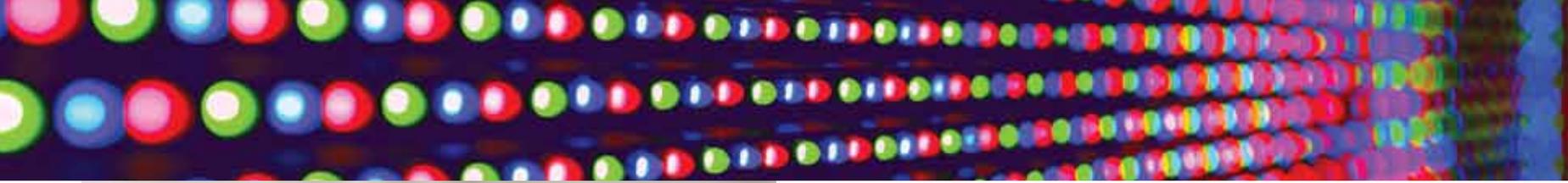
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### Defining the useful life of LED light sources

The Alliance for Solid State Illumination Systems and Technologies (ASSIST)—a group led by the Lighting Research Center at Rensselaer Polytechnic Institute in Troy, N.Y.—has published a series of recommendations defining the useful life of LED light sources. ASSIST defines *useful life* as the length of time a light source delivers a minimum acceptable level of light in a given application.

Research performed by ASSIST indicates that changes in general office lighting levels go largely undetected as long as light levels stay above 70% of their initial levels, especially when the changes are gradual. For general lighting applications, therefore, ASSIST recommends defining useful life as the length of time it takes an LED light source to reach 70% of its initial light output (L70). For decorative and accent applications, ASSIST recommends defining useful life as the length of time it takes an LED light source to reach 50% of its initial output (L50).

L70 and L50 are widely used by the LED lighting community as two important thresholds for useful life, covering a range of lighting applications.

### The lumen maintenance gap

All well and good... so far. But there's a disconnect between the test results typically provided by LM-80 on the one hand and the L70 and L50 thresholds that define useful life on the other. This disconnect, which could be called the *lumen maintenance gap*, is the source of a fair amount of confusion among professionals who need to understand how long an LED lighting system will deliver effective light in a particular application. This understanding is crucial for making valid comparisons between conventional and LED lighting fixtures, and for accurately calculating installation, maintenance and replacement costs. Let's see if we can sort things out.

### Lumen maintenance of LED and traditional light sources

When properly controlled and driven, LED light sources can have useful lives that last considerably longer than the rated lives of conventional sources. The following table compares the typical useful life range of LED light sources with the typical rated life ranges of conventional light sources. (Source: U.S. Department of Energy)

Light source	Typical range (hours)
Incandescent	750 to 2000 / rated life
Halogen incandescent	2000 to 4000 / rated life
CFL	8000 to 10,000 / rated life
Metal halide	7500 to 20,000 / rated life
Linear fluorescent	20,000 to 30,000 / rated life
White-light LED	35,000 to 50,000 / useful life (L70)

LM-80 requires testing of LED light sources for 6000 hours, but recommends testing for 10,000. So that users can see the effects of temperature on light output, LM-80 calls for testing LED sources at three junction temperatures (55°C, 85°C and a third temperature to be determined by the manufacturer), and specifies additional test conditions to ensure consistent and comparable results.

Unfortunately, LM-80 provides no recommendations on how to extrapolate measured data to L70 or L50. (Such a methodology, IES Technical Memorandum TM-21, is currently under development). Until TM-21 is published, the only way an LED source manufacturer can claim its L70 and L50 figures conform to LM-80 is to measure their LED sources until they reach those thresholds. Since a typical L70 number is 50,000 hours, such a test would last longer than five years! Not only would this test be impractical, but LED technology evolves so quickly that a given product would be obsolete by the time the test was completed.

In practice, leading LED source manufacturers test their products to the LM-80 minimums of 6000 or 10,000 hours, then apply their own extrapolation methodologies to arrive at L70 and L50 figures. Since these methodologies are proprietary, manufacturers can choose to disclose as much or as little of the mathematics and supporting data as they wish.

For example, one LED source manufacturer publishes the raw data for a high-performance white-light LED. Its report includes data on a significant sampling of devices, each tested to 6000 hours in accordance with LM-80 methods, and L70 extrapolations based on an exponential model. While this set of data is sufficient to establish the manufacturer's credibility, users would benefit from more transparency into the model's extrapolation formulas and assumptions.

Another LED source manufacturer bases the lumen maintenance model for a high-performance white-light LED on its interpretation of raw LM-80 test data. According to its published specifications, the data indicates that lumen maintenance is linear after the first 5000 hours of operation, so the manufacturer applies a linear model using variables such as thermal pad, junction and ambient temperatures, and drive current. While it does not disclose its extrapolation formulas or raw test data, the manufacturer explains its approach, and provides a set of charts to show expected lumen maintenance to L70 at different ambient temperatures and drive currents.

Regardless of the extrapolation method used, keep in mind that while L70 and L50 figures may be based on LM-80 measurements, they are not LM-80 measurements.

### Useful life of LED sources in lighting fixtures

The approved method for making photometric measurements of LED lighting products specifically calls for the testing of complete LED lighting fixtures (as spelled out in IES LM-79-08). The approved method for measuring lumen maintenance is just the opposite: it calls for the testing of LED light sources—not complete LED lighting fixtures. LM-80 explicitly defines light sources as “packages, arrays and modules only”. This means that LED fixture manufacturers must define their own methods of calculating lumen maintenance for their LED lighting fixtures. As with L70 and L50 figures provided by LED source manufacturers, lumen maintenance figures provided by LED fixture manufacturers may use LM-80 test data and lumen maintenance extrapolations upon them, but they are not LM-80 measurements.

Ambient and internal operating temperatures and drive currents have a significant effect on the lumen maintenance of LED light sources integrated into lighting fixtures, but so do many features of the fixtures themselves, including lensing, housing colour, quality of components and thermal design. Operational factors such as power surges, static discharge, vibration and moisture infiltration can also have a significant effect. LM-80 testing for complete LED lighting fixtures would be prohibitively complex and expensive for manufacturers, as they would have to test every different version of their fixtures to account for the effect of each feature or combination thereof.

In practice, then, reputable LED fixture manufacturers ensure their fixture drive currents and operating temperatures (especially junction temperatures) fall within the ranges specified by LED source manufacturers in their lumen maintenance reports. The fixture manufacturers then make their own calculations of the useful life of the LED sources integrated into their lighting fixtures, based on their understanding of the effects of specific physical and operational features.

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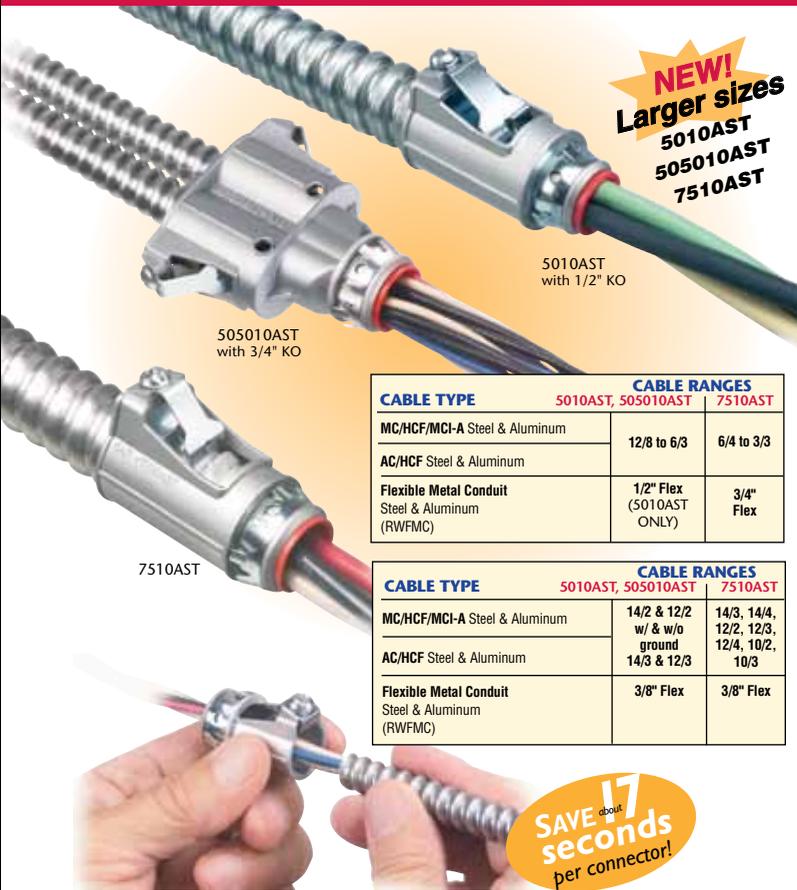


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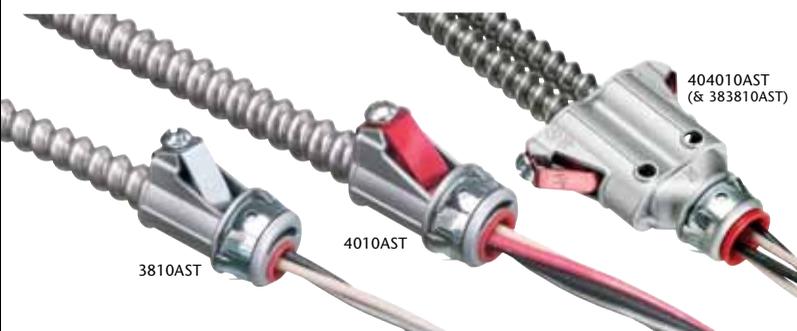
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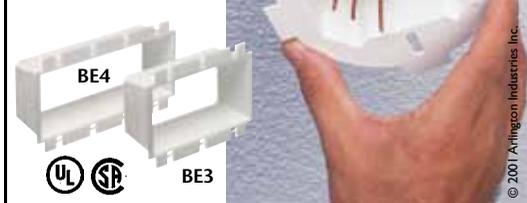
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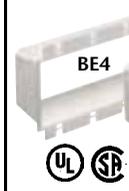
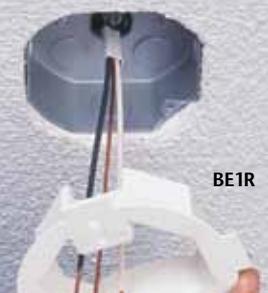
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## Useful life is not fixture lifetime

It's important to keep in mind that useful life and fixture lifetime are two very different things. The *useful life* of a fixture refers to the lumen maintenance projections of the LED sources integrated into that fixture; in plain English, the number of hours an LED lighting fixture will deliver a sufficient amount of light in a given application.

*Fixture lifetime*, on the other hand, has to do with the reliability of the components of an LED lighting fixture as a system, including the electronics, materials, housing, wiring, connectors, seals and so on. The entire system lasts only as long as the critical component with the shortest life, whether that it's a weather seal, an optical element, an LED or something else. From this point of view, LED light sources are

simply one critical component among many (although they are often the most reliable component of the whole lighting system).

Reputable LED lighting fixture manufacturers spend a great deal of time and effort designing and developing all aspects of a lighting system, including control algorithms, board layouts, component quality, thermal management features, optics and mechanical design. The LED lighting fixture design is then typically validated through a series of in situ tests to verify that the fixture is meeting the expected performance levels for heat dissipation, light output and so on. Since all the aspects of an LED lighting fixture are interdependent, operational performance can be determined only by testing the fixture as an integrated system.

## Comparing the useful life of conventional lamps and LED lighting fixtures

Since all electric light sources experience lumen depreciation, it ought to be possible to extrapolate rated life and lumen depreciation figures for conventional light sources to arrive at L70 (and L50) figures. This would allow lighting designers and specifiers to compare apples to apples; that is, the useful life of LED sources as incorporated in lighting fixtures with the useful life of incandescent or fluorescent lamps.

### *Incandescent comparison*

A 60-watt incandescent lamp has a rated average life of 1000 hours. If we assume typical light loss of 10% to 15% over its life, the lamp will fail before reaching the L70 threshold. Therefore, its rated life is basically its useful life.

### *CFL comparison*

An 18-watt CFL lamp has a rated life of 15,000 hours, 1250 initial lamp lumens and 1125 design lumens, which represents a 10% loss after 6000 hours of operation. The lamp will therefore reach L70 after 18,000 hours. But since the lamp is expected to fail after 15,000 hours, its rated life is, effectively, its useful life.

### *Fluorescent tube comparison*

High-performance fluorescent lamps are now available with significantly extended rated lives. For example, a 48-in., 32-watt T8 with an average rated life of 33,000 hours loses 5% of its initial light output after 13,200 hours, or 40% of its rated life. At a constant rate of lumen depreciation, the lamp would reach L70 at 79,200 hours of operation—a figure that rivals the useful life of many LED light sources. Still, the lamp is expected to



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fail after 33,000 hours, long before it reaches the L70 threshold. Therefore, its rated life—not its estimated L70 threshold—is, effectively, its useful life.

#### HID lamp comparison

An HPS lamp, used for streetlighting and outdoor area illumination, lists a rated average life of 24,000 hours. Unlike rated life for the fluorescent and incandescent examples above, rated life for this lamp is based on survival of 67% of the tested lamps (instead of 50%). At 9600 hours of operation, the lamp maintains 90% of its initial lumen output, which puts its L70 threshold at 28,800 hours. While the lamp's rated life and L70 measurements are roughly equivalent, the rated average life is still slightly lower. Again, its rated life is, effectively, its useful life.

As these examples demonstrate, rated life is generally equivalent to useful life for conventional light sources, as they typically fail before they reach the relevant lumen maintenance thresholds. Comparing useful life figures for LED lighting fixtures with rated life figures for conventional lamps, then, affords a valid evaluation of how many relampings you can avoid by using LED-based alternatives to conventional lighting solutions. This evaluation, in turn, offers important information for total cost of ownership comparisons.



#### Getting dependable, accurate information

Given the lack of transparency in the lumen maintenance projections of both LED source and fixture manufacturers, how can professionals evaluate whether a fixture manufacturer's useful life figures are accurate?

To begin with, always look for a reputable fixture manufacturer with a proven track record, and make sure that it offers a comprehensive set of published specifications, photometric data and related information. Remember, you cannot simply ask an LED fixture manufacturer for its LM-80 data: as we've seen, only LED source manufacturers obtain LM-80 data, and only for a period of operation significantly shorter than accepted useful life thresholds.

Nevertheless, you can increase your confidence in an LED fixture manufacturer's useful life figures by ensuring that:

- The manufacturer of the LED sources incorporated into an LED fixture were tested in accordance with LM-80.
- The LED source manufacturer uses a valid method of projecting LM-80 test results to L70 and L50 based on recommended operating conditions.
- The LED lighting fixture manufacturer performs its own measurements of junction temperature, drive current and other relevant factors, and bases its fixture's L70 and L50 figures on LM-80 extrapolations provided by the LED source manufacturer.
- The LED fixture manufacturer bases its published photometric data on test results from an independent NIST-traceable testing lab, using absolute photometry in accordance with methods and conditions spelled out in LM-79.

Leading LED fixture manufacturers design their fixtures to ensure that they are as durable and reliable as possible. Although fixture failures do sometimes occur, well-designed LED lighting fixtures can perform reliably for many thousands of hours, often until the LED sources within them have reached the end of their useful life. **EB**

*With files from Philips Solid-State Lighting Solutions Inc. Technical Brief, "Useful Life: Understanding LM-80, Lumen Maintenance, and LED Fixture Lifetime," 2010.*



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# Playing it safe with digital multimeters

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When it comes to electrical safety, voltage spikes are an unavoidable hazard. As distribution systems and loads become more complex, the possibilities of transient overvoltages increase. Motors, capacitors and power conversion equipment (such as variable speed drives) can be prime generators of spikes. Lightning strikes on outdoor transmission lines also cause extremely hazardous high-energy transients.

These transients are largely invisible when taking measurements on electrical systems,

yet can occur regularly on low-voltage power circuits and reach in the many thousands of volts. Therefore, it is important for anyone working on electrical circuits to understand the best combination of tools and procedures to ensure their safety.

## Knowing your tools

The first thing to consider is your multimeter. Many technicians believe that choosing a multimeter with a high-enough voltage rating guarantees its safety. That's not necessarily the

case, especially when it comes to voltage spikes. Momentary high-voltage spikes or transients can hit the unit without warning.

This is why it is important to have a meter that has the appropriate built-in safety margin. Users must look beyond the voltage rating, since that alone will not tell you how well that meter was designed to survive high-voltage transient impulses. When working on high-energy circuits especially, it's important to ensure that the meter is certified to CSA C22.2 No. 61010, which is based on the IEC (International Electrotechnical Commission) 61010 standard.

The real issue for multimeter circuit protection is not just the maximum steady-state voltage range, but a combination of both steady-state and transient overvoltage-withstand capability. Transient protection is vital because when transients ride on high-energy circuits, they tend to be more dangerous.

When a transient causes an arc-over, the high current available from the system being measured can sustain the arc, producing a plasma breakdown or explosion. This occurs when the surrounding air becomes ionized and conductive. The resulting arc blast is a disastrous event. In fact, arc blasts cause more electrical injuries every year than electric shock.

## Know your categories

When checking out a meter's safety, the most important single concept to understand is the Overvoltage Installation Category. The standard defines Categories I through IV, often abbreviated as CAT I, CAT II, etc. The division of a power distribution system into categories is based on the fact that a dangerous high-energy transient will be attenuated or dampened as it travels through the impedance (AC resistance) of the system.

A higher CAT number refers to an electrical environment with higher power available and higher energy transients. Thus, a multimeter designed to a CAT III standard is resistant to much higher energy transients than one designed to CAT II standards.

Within a category, a higher voltage rating denotes a higher transient-withstand rating, i.e. a CAT III-1000V meter has superior protection compared to a CAT III-600V rated meter. The real misunderstanding occurs when someone selects a CAT II-1000V-rated meter thinking it is superior to a CAT III 600V meter.

It is essential that the working environment be considered first, and equipment with an appropriate or higher CAT rating be used. Once the required CAT rating is known, then—and only then—can a unit with a suitable voltage range can be selected.

Users should also bear in mind that transients aren't the only source of possible short circuits and arc blast

hazard. One of the most common misuses of hand-held multimeters can cause a similar chain of events; a user making current measurements on signal circuits, for example, would typically select the Amps function, insert the leads in the mA or amps input terminals, open the circuit and take an in-series current measurement.

When the test leads are left in the Amps terminals then accidentally connected across a voltage source, the low-input impedance becomes a short circuit. In these cases, it doesn't matter if the selector dial is turned to Volts; the leads are still physically connected to a low-impedance circuit.

Amps terminals, therefore, must be protected by fuses, since they are the only thing standing between an inconvenience (i.e. blown fuses) and a potential disaster. It is important to use only a multimeter with Amps inputs protected by high-energy fuses specified by the manufacturer.

#### Safety first

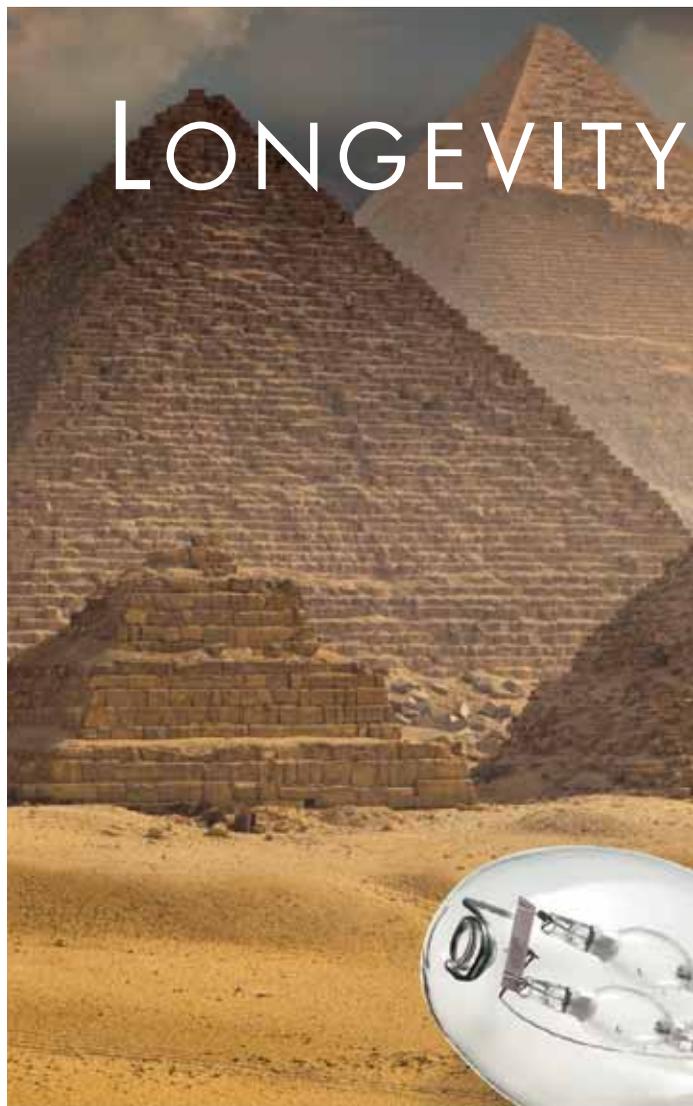
No single tool can guarantee safety on the job. Some best practices to remember include:

- Work on deenergized circuits whenever possible. Use proper lockout/tagout (LOTO) procedures. When these procedures are not in place nor enforced, assume the circuit is live.
- On live circuits, use protective gear as defined in CSA Z462 or NFPA 70E including, but not limited to, insulated tools, safety glasses or face shield, and insulated gloves. Remove watches and other jewellery and stand on an insulated mat. Also, wear appropriately rated arc and flame protecting clothing.
- When taking measurements on live circuits, hook on the ground clip first, then make contact with the hot lead; then, remove the hot lead first, followed by the ground. Where possible, hang or rest the meter to minimize exposure to the effects of transients.
- Use the three-point test method, especially when checking to see whether a circuit is dead: First, test a known live circuit. Second, test the target circuit. Third, test the live circuit again. This verifies your meter worked properly before and after the measurement.

- Use the old electrician trick of keeping one hand in your pocket. This lessens the chance of a closed circuit across your chest and through your heart.

When it comes to the electrical safety, maximum protection is a combination of the right tools and safe work practices. An important first step is to take the time to understand your multimeter specifications and safety features, then apply common sense on the job. **EB**

*Colin Plastow has been with Fluke Electronics Canada since 1987 in various support and product management positions. Today, as industrial product manager for Fluke, he brings his expertise in electronic test and measurement to customers in high-tech and industrial markets. Plastow continues to share his in-depth industry knowledge through various customer seminars, as well as educational articles published in leading industry publications. He can be contacted at [colin.plastow@fluke.com](mailto:colin.plastow@fluke.com).*



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# Université Laval receives high marks in fire protection

Network offers campus-wide system control and preparation for future emergency communications systems

Established in 1852 in Quebec City, and recognized by UNESCO as a World Heritage Site, Université Laval was the first French-speaking university in North America. In 1950, construction began on its main campus in Sainte-Foy, which was then on the outskirts of the city. It has grown into what is now referred to as a city within a city.

The university's statistics are impressive: the 300-acre campus has over 32 buildings which are linked by 10 kilometres of underground pedestrian and service tunnels designed to cope with harsh Canadian winters. The university hosts a sizeable community of about 44,000 students and 8000 employees within an urban/rural setting of dense woods, grasslands and sports fields covering more than half the campus.

## Unified solution

A few years ago, the university's board of governors decided to allocate funds for a new state-of-the-art, code-compliant fire protection network spanning all 32 buildings campus-wide. The old fire alarm systems were an aging conglomeration of different makes and models. Moving forward, the university sought bids for a standardized system from a single supplier for a true proprietary fire alarm solution. The bid was won by an addressable fire protection system, and it involved replacing every alarm panel, detector and supervisory device.

"I'm from the insurance industry and I've never seen a system quite as big as this. It has 35 panels and more than 20,000 supervisory and detection devices," says Pierre Paquin, fire prevention coordinator for Université Laval.

The old systems presented a series of faults on a regular basis that could have resulted in serious problems. Moreover, the mixture of equipment throughout the campus made it difficult for the university's security personnel to deal with all of the individual systems. "Each time someone new joined the staff, they had to be trained in how to use all of the different panels. That's one of the main reasons we decided to standardize," says Paquin.

## Network management

Each building is protected by its own stand-alone fire alarm control panel, each functioning as a node on the network. The campus' network of 35 panels is a combination of Notifier AM-2020 and Onyx Series NFS-3030 panels connected via 42 kilometres of multimode fiber optic cable run in conduit installed throughout the school's network of tunnels.

"We have a building about 50 miles

away in the Laurentians, in the woods," says Paquin, "That building is also part of our network, and is linked in by IT over a commercial phone line."

Each node on the system acts as a repeater to reshape and regenerate data signals. Therefore, any damage incurred by one or more nodes due to fire, tampering, etc., will not effect operations and communication among the surviving nodes.

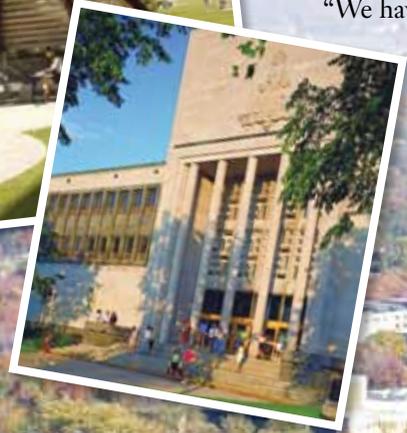
For added redundancy, the university installed Style 7 (DCLC) circuits in which the cable carrying all incoming and outgoing signals are looped through the system in separate conduits. According to Paquin, this type of integration helps to ensure a single line break does not interrupt the transmission of alarm communications.

The university's new fire alarm performs as one solitary system supported by Noti-Fire-Net—a high-speed (312,500 bps) data communications network. It allows each control panel to maintain its own area of protection while providing monitoring and control capabilities for all other network nodes.

Two NCSs (network control stations)—one at the school's main 911 command centre and another at an emergency back-up location—provide immediate monitoring and control of the entire fire alarm network. The NCS is a rack-mounted computer customized with detailed, full-colour graphics of the university campus down to individual building floor plans.

During an event, the NCS automatically zeroes-in on the area displaying an alarm while the cursor changes to indicate any onscreen alarm activity. With an operating environment similar to Windows, authorized personnel can easily navigate through the screens using simple mouse-clicks.

The NCS houses an unlimited history of system information, including operator logins, events and response data—all stamped with



Exterior photos courtesy Université Laval

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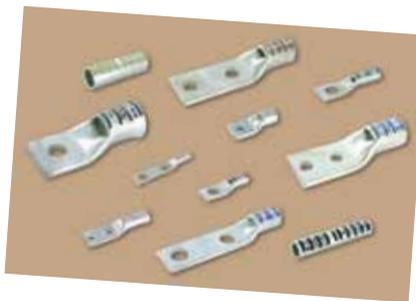
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One of the school's fire alarm control panels.



Université Laval's 911 command centre.



A recent disaster response drill at Université Laval.

time and date. A hard copy of each event is also generated by a network printer.

Ease of system maintenance is another NCS highlight. "One of the uses of the NCS is that it allows us to individually deactivate any detectors or supervisory devices for renovation or testing. We can even deactivate the alarms in an entire building when we perform required testing on fire pumps or sprinkler systems," says Paquin.

As a back-up to the NCS, a remote annunciator is also connected to the network. The network control annunciator features an LCD display and operator keypad offering the university's security and facilities staff an alternate means of monitoring and control functions for the entire network.

#### High standards

Local building codes and standards set by Underwriters Laboratories of Canada dictated the majority of the university's fire alarm design. Acting as its own AHJ (authority having jurisdiction), Université Laval decided to exceed these requirements in certain areas.

For example, many of the classrooms have now been wired for students to plug-in laptops, which raised concern that this would increase the probability of electrical fires. Although code only requires rate-of-rise heat detectors in classrooms, the university decided to install the more-expensive heat & smoke detector-combination to provide more thorough detection and faster response.

Although detectors are not required in most locations protected by sprinklers, the university decided to install detectors anyway, considering they would respond more quickly than the sprinklers.

These added precautions not only increased the level of protection, but also enabled the school to receive more favourable terms from its insurance provider.

#### Test and tune-up

Paquin indicates the insurance industry typically pays more attention to sprinklering, not detectors—usually because they are poorly maintained. To assist in the regular maintenance and testing of detectors, the system's detectors and supervisory devices are simple plug-in appliances with built-in dials for easy addressability—no software interventions are necessary. The university emphasizes that all smoke detectors are tested annually using the prescribed methods for this process.

#### Protection evolution

Université Laval soon plans to migrate from the NCS to the latest graphic workstation from its supplier.

This desktop system will provide the school's security and facilities personnel with a single-point of control for the entire fire alarm network, as well as security, access control and video systems. This system can also support live voice paging for mass notification—a key reason for this upgrade.

To upgrade its fire alarm network to also serve as an emergency communications system, the university will add DVC (digital voice command) to each control panel. The DVC can deliver pre-recorded, event-driven messages, as well as live voice paging by microphone to specific areas or the entire campus.

The university is part of the International Association of Campus Law Enforcement Administrators (IACLEA). "Although our crime rate in Quebec City is virtually nil, we know something could happen. There could be dangerous snowstorms, hazardous waste spills and campus-wide lockdowns," Paquin declares. "We also have to consider that we have students and faculty from over 90 different countries around the world. An emergency communications system would make a vital contribution to our life safety."

Today, Université Laval understands the significance of a standardized fire alarm system that is easy to monitor and maintain. However, the ultimate reward is the fast response and advanced protection provided to all who walk the halls of this historic campus. **EB**

— With files from Notifier, [www.notifier.com](http://www.notifier.com).



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Perfect for use in high-rise, post-tensioned buildings, the new ENT Support Unit (ESU) raises the tubing or conduit up off the concrete

form to maintain a level raceway during the concrete pour. With its minimal surface contact, the ESU allows for maximum aggregate flow and concrete consolidation. Constructed with an easy locking mechanism for any 1/2" to 2" sized ENT, the ESU saves installation time and labour compared to using traditional tie wire. The plastic material also eliminates corrosion on exposed surfaces.

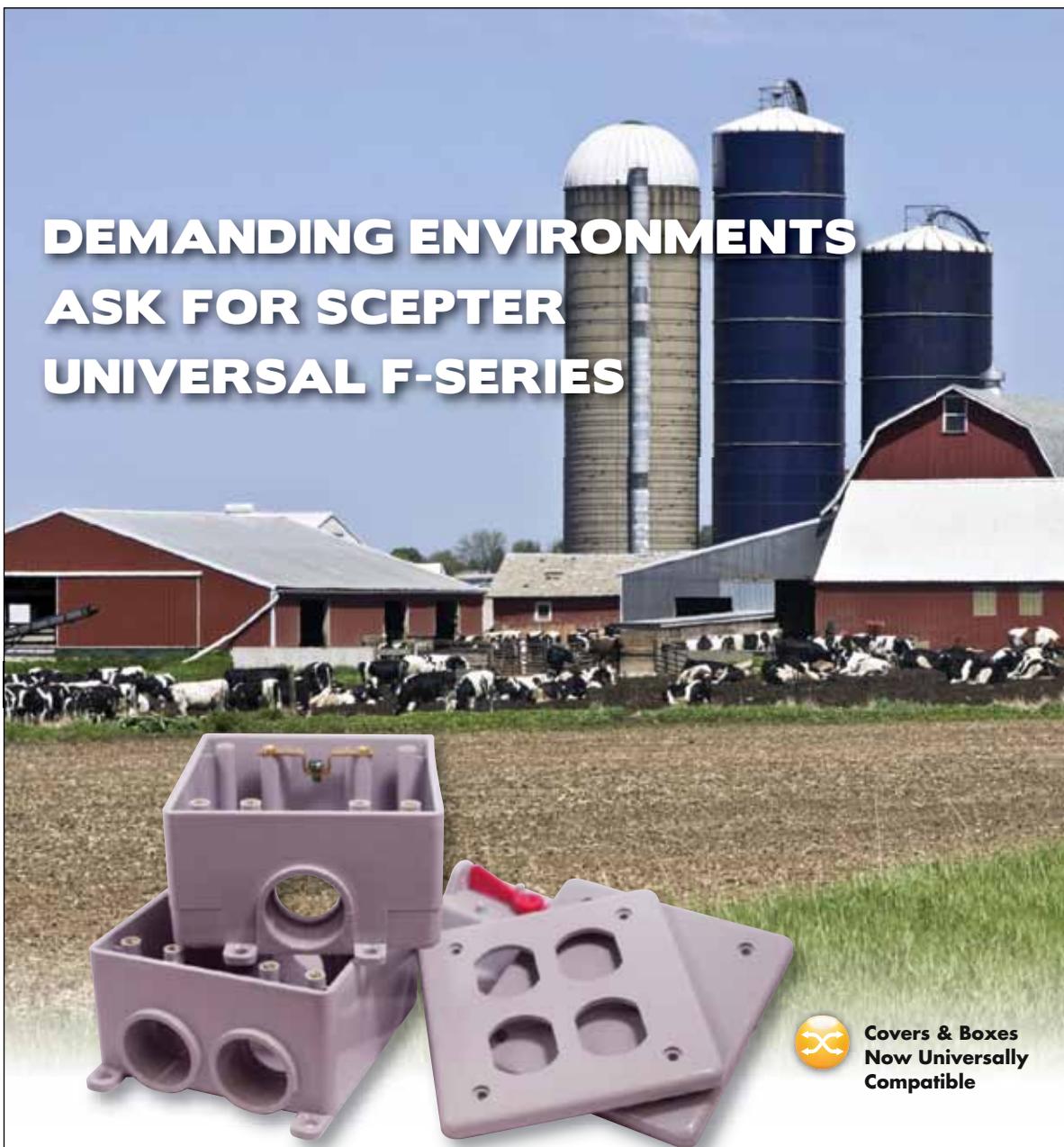
## EPR Kit Adapters make Duct repairs quick and easy!



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## EB lighting products

### Standard B11, PAR16, MR16 and GU10 retrofit LEDs



Standard Products has extended its retrofit LED lamp line to include a B11 2-watt candle lamp that emits a light delivering “ambiance and style” for less energy than its 15-watt incandescent equivalent. It’s suitable for wall scones and chandeliers in reception areas and lobbies. There are also a 3.5-watt MR16, GU10 and PAR16 in 3K and 4K colour temperatures, all of which are offered with a 38° beam. The lamps provide 35,000 of life, reducing relamping costs while reducing energy consumption without compromising fixture design. They offer instant on light from UV emissions and mercury.

**STANDARD PRODUCTS**  
www.standardpro.com

### Cooper Lighting Metalux Commercial, OpticaHP, Archos and Cruze retrofit kits



Cooper Lighting has introduced a series of four contractor-friendly Metalux fluorescent retrofit kits which it claims were designed to meet and exceed today’s energy needs and guidelines while improving light quality. The retrofit kits consist of architecturally inspired designs that update a building’s look and value, boasts Cooper, while offering a range of features and benefits that save energy, time and money when compared to similar new construction T8 or T5 luminaire offerings. Its contractor-friendly features include pre-wired ballast and assembly, no parts bag, and installation in less than 10 minutes.

**COOPER LIGHTING**  
www.cooperlighting.com

### RC Lighting offers “LGoose” LED fixture



RC Lighting has introduced the LGoose: an LED-based alternative to the traditional “Gooseneck” lamp for retail store exteriors that, it says, delivers a combination of light quality, energy-efficiency, long life, and affordability. According to RC, the LGoose drives 80% energy savings and provides “many years of maintenance-free light output without compromising quality of light”. Additionally, the 13-watt LED features a neutral-white colour temperature of 4000K and a colour rendering index (CRI) of 86.

**RC LIGHTING**  
www.rclighting.ca

### 13W and 23W GU24-based dimmable spirals from Standard

Standard Products has added 13- and 23-watt GU24 based spirals to its Dimmable series, both of which are available in a warm, 2700K colour and can be used in totally enclosed fixtures. Also, a complete



series of cULus-listed high-wattage spirals has been added to the CFL category. The new lamps are available in 55- and 65-watt (replacing 300-watt incandescents) as well as 85-watt and 105-watt (replacing 350- and 400-watt incandescents, respectively). They are available in 2700K and 5000K (the 105-watt are offered in mogul base-E39). The bulbs’ spiral design shortens the length of the lamp, and boast an average life of 10,000 hours. Their design also allows for minimal light trapping, says Standard, creating more light output and providing “a light distribution that is very close to incandescent”. The high-wattage spirals are suitable in high and low bays, gymnasiums, warehouses and garages.

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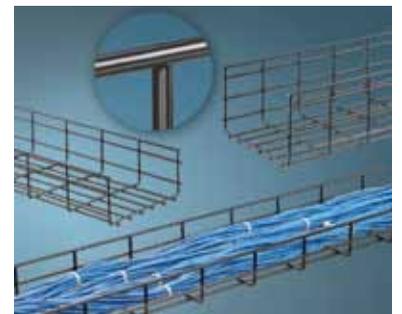


Truck cap manufacturer A.R.E. is offering commercial customers a fiberglass truck cap called the ToolMaster Series, which is available for all current-model trucks. The series is a rugged truck cap featuring heavy-duty doors, two steel toolboxes (each with a 120-lb weight capacity), and a commercial-grade Prime Design AluRack roof rack with a ladder rack roller, says the company, adding that side and rear doors with aluminum inserts for privacy and security also come standard on the series. Optional accessories for the series include Kargo Master bed-mounted racks, BedSlide rolling drawer systems, and AluRack locking ladder attachments.

**A.R.E.**  
www.4are.com/fleet

### Pentair Technical Products offers Hoffman Quick Tray Pro cable trays

Pentair Technical Products offers the cUL- and UL-listed Hoffman Quick Tray Pro line of cable tray featuring, boasts the company, enhanced aesthetics, numerous size offerings and diverse accessories. The cable tray features a non-snagging T-weld design, eliminating hazardous sharp edges and catch points, and



ensuring reliable cable organization and protection. Available sizes include 2-in., 4-in. and 6-in. depths and widths from 4 in. to 24 in. Meantime, fill ratings range from 122 to 2200 cables.

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**GE introduces EverGold SVT Series grid tie solar inverters**



GE Energy Industrial Solutions claims its new GE EverGold SVT Series grid tie solar inverters for residential and small commercial photovoltaic systems are engineered for

flexibility in system design and for ease of installation. They are now available to distributors, integrators and contractors for new construction and retrofit projects. According to the company, the transformerless design reduces inverter weight to about one-half of that of traditional transformer-design inverters on the market, making the installation of solar energy systems that much easier.

**GE**  
[www.geindustrial.com/solar](http://www.geindustrial.com/solar)

**Milwaukee 5262-21 7/8" SDS Plus D-handle rotary hammer**



Milwaukee Electric Tool Corp. has introduced a 7/8" SDS Plus D-handle rotary hammer that, it says, lasts longer and drills faster than other tools in its class. The 5262-21 provides up to 15% more life in even the toughest applications and provides up to 40% faster drilling with 2.4 ft-lb of impact energy and 0-1500 rpm, it boasts, adding that the three-mode operation promises maximum versatility—regardless of application—while a mechanical clutch protects the motor when the bit binds.

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**MCG Surge Protection PT Series AC powerline protectors**



MCG introduced the PT Series of AC powerline protectors. The UL 1449 3rd edition-listed PT80 contains high peak-current fuses and large thermally protected varistors that promise reliable and safe protection

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**Irwin Tools unveils 4-point snap blade**

Irwin Tools has developed a new 4-point snap blade that snaps on the score to create four cutting points, doubling the number of cuts made by standard carbon blades, it says. According to Irwin, the blade gives tradesmen instant



access to a sharp new point without the hassle of having to constantly change blades.

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**November 4**, Ottawa, Ont.  
**November 22**, Mississauga, Ont.  
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**Solar Power International**  
**October 17-20**, Dallas, Texas  
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**Canadian Electrical Code & Electrical Safety Conference CSA Standards**  
**October 18-19**, Toronto, Ont.  
**October 25-26**, Saskatoon, Sask.  
**November 23-24**, Calgary, Alta.  
**December 5-6**, Halifax, N.S.  
 Visit [shop.csa.ca](http://shop.csa.ca)

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*British Columbia Electrical Association*  
**November 2**, Vancouver, B.C.  
 Visit [www.bcea.bc.ca](http://www.bcea.bc.ca)

**AEL EConference**  
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**November 23**, Calgary, Alta.  
 Visit [www.elecleague.ab.ca](http://www.elecleague.ab.ca)

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# What's wrong with Rule 14-100?

Canadian Electrical Code (CEC) Rule 14-100 has requirements for reducing wire sizes connected to splitters and junction boxes, and for control circuits, such as pushbutton stations. The rule prescribes the minimum construction requirements for mechanical protection and maximum unprotected lengths of conductors so as to produce a safe installation. The rule is consistent in its overall requirements *except* for Subrule 100(d), which appears to be totally at odds with the remainder of the rule.

We see that Rule 14-100(d) specifies that conductors from the secondary side of a high-voltage transformer (impedance up to 7.5%) may be installed without any limitation in length so long as:

- they terminate in overcurrent protection;
- the transformer has secondary protection, maximum 250% of FLA;
- the transformer's primary side is protected in accordance with Rule 26-252(1), (2) and (3); and,
- the wiring is protected against mechanical damage.

Let's look at an example: the installation of a 5000 kVA, 44 kV/600V transformer. The secondary full-load amperes of this transformer will be about 5000 amperes. When the transformer's secondary overcurrent protection does not exceed

Table 1

Example	Conductor line side protection	Conductor load side protection	Maximum conductor length
Rule 14-100(d), 600-volt secondary supply from a 44 kV/600V, 5000 kVA transformer	Transformer primary overcurrent protection set to maximum 600% FLA	Wire size 7500 A. Overcurrent protection 7500 A at load end. Short-circuit protection 30,000 A	Unspecified
Rule 14-100(c), 600-volt tap from a 600-ampere splitter	600-ampere splitter protection	Wire size 200 A. Overcurrent protection 200 A at load end. Short-circuit protection 600 A.	7.5 m

250%, Table 50 permits overcurrent protection on the primary side up to 600% FLA for a circuit-breaker and 300% for fuses.

Let's assume that the transformer has primary protection set to 600% as permitted by Table 50. This would allow up to 30,000 amperes secondary fault current (6 x 5000A). Assume secondary protection set to 150% FLA at the load end of the secondary conductors would provide overload protection. Since overcurrent protection is located at the load end, 30,000 amperes short-circuit protection for the conductors will be provided by the transformer's primary side protection. And you likely noticed that the maximum length of unprotected wiring is unspecified.

In comparison, let's look at Rule 14-100(c) which permits conductor sizes to be reduced at splitters or junction boxes so long as:

- the reduction in ampacity is to not less than 1/3 of the larger;

- the conductors are protected from mechanical damage;
  - the conductors terminate in overcurrent protection no greater than the ampacities of the conductors; and,
  - conductor length is no greater than 7.5 m.
- An example might be a tap from a 600-volt, 600-ampere splitter. Here, the conductor ampacity must not be reduced to less than 200 amperes, and the length of unprotected wiring restricted to a maximum 7.5 m. Meantime, 200-ampere overcurrent protection must be provided.

Based on our two examples, we can summarize the differences between Rules 14-100(d) and (c) as shown in Table 1.

No doubt you noticed that, in either example, *there is no overcurrent protection* at the conductors' point of supply. In our second example, the wiring length is restricted to 7.5 m while, in the first, there is no restriction in conductor length—even though the conductors may experience much higher fault currents. What do you think? **EB**

*Les Stoch is president of L. Stoch & Associates, specialists in quality management/engineering services. He is a member of PEO, OEL and LAEI, 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](http://www.lstoch.ca).*



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## Tackle The Code Conundrum... if you dare

Answers to this month's questions in November'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

Does the CEC permit a #8 AWG system grounding conductor—free from exposure to mechanical injury—to run exposed along the surface of a building construction without protection?

- a) Yes
- b) No

### Question 2

It is permitted to use electrical non-metallic tubing (ENT) underground and in concealed locations; however, it is not permitted to install ENT in exposed locations.

- a) True
- b) False

### Question 3

The CEC requires a splitter to be installed where two or more conductors are connected to a conductor larger than \_\_\_ copper.

- a) #4 AWG
- b) #6 AWG
- c) #1/0 AWG
- d) #2/0 AWG

### Answers to Code Conundrum EBMag September 2011

**Q-1:** Class H fuses are permitted to be used for overcurrent protection where circuit overload protection is provided by other means.

- b) False

**Q-2:** Can an insulated #6AWG wire be marked in a permanent manner with a green colour to be used as a bonding wire?

- b) No

**Q-3:** What is the minimum distance for spacing between supports for electrical non-metallic tubing?

- c) 1.0 m

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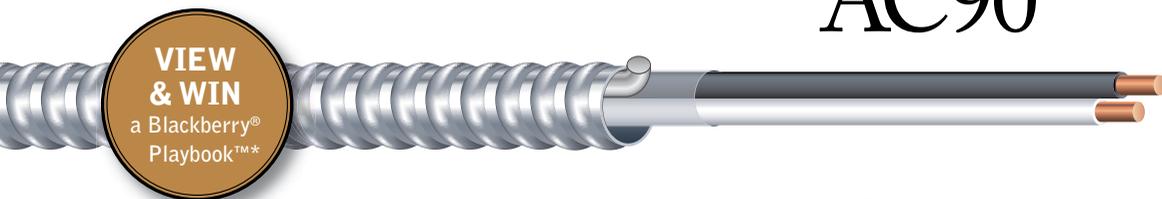


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