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Electrical Business

AUGUST 2013



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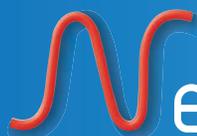
■ Also in this issue...

- Selecting the right bearing seal
- Speed & accuracy with estimating software

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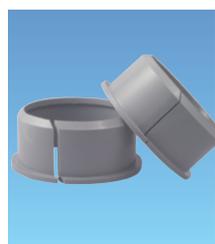
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EPR Kit Adapters make Duct repairs quick & easy!



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

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That's why we're here: to be your eyes and ears on the street... your own personal reporters.

You have your own personal reporters

For me, the summer months are a great time to catch up after weeks upon weeks of travelling from one industry event to another. In fact, I could safely wager no other electrical magazine works as hard as the EBMag team to get out into Canada's electrical community to meet and chat with you, our readers, who range from electrical contractors and maintenance staff to regulators, engineers, manufacturers and distributors, sales agents and more.

What we glean from those conversations—and from the emails and Letters to the Editor we receive—forms the foundation for topics we cover in the magazine and online. Our mission is to be in tune with you and, where possible, bring you news and information you would not have learned elsewhere—information that will help you better understand the electrical climate in Canada, and where opportunities for business growth can be found.

We know you're busy... if not on the jobsite, then preparing bids or maybe taking some well-deserved time off. That's why we're here: to be your eyes and ears on the street... your own personal reporters.

For example, EBMag recently attended the annual conference of Electro-Federation Canada's Electrical Council (photo), whose membership consists of leading manufacturers and distributors operating in Canada. Were you able to attend, what would you ask them? What would you complain about? Is there anything for which you would congratulate them?



Put us to work and let us be your voice! EBMag is on the road again in the fall. Among our travels, we're off to: Electrical Contractors Association of Ontario (ECAO) Annual Industry Conference; NECA Show (National Electrical Contractors Association) in Washington, D.C.; Affiliated Distributors Electrical Supply Division's North American Meeting in Maryland; Electricity Human Resources Canada's (EHRC's) Conference and Inaugural Awards Gala and more.

I encourage you to check out our Calendar (in print here and online at EBMag.com) to see where we're headed, then send me your questions/concerns. It's my job to get you the answers. **EB**

Anthony Caplan



On the cover and page 10

With 10 elevators, why is everyone using the stairs?

There was a bank of 10 elevators in this building, but most everyone was using the stairs. Had some sort of a corporate physical health edict been declared, or was something more ominous going on?
(Stock photo)

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14 A guide to selecting the right bearing seal

The primary functions of a bearing seal are to keep lubricant in the bearing and bearing chamber, and to exclude contaminants from that area. This article focuses on seals that are external to the bearing and, therefore, not part of the bearing itself.



17 Add speed and accuracy with estimating software

When it comes to professional estimating software, contractors and estimators who gain a better handle over time on exactly what they have on their desks end up the most satisfied. Computerized estimating software is nothing more than a tool, albeit a tool with a lot of great functions and facets.



DEPARTMENTS

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Burndy and Burndy Canada acquire Connector companies and Barfield brand

“I am pleased to announce that Burndy LLC and Burndy Canada Inc. (www.burndy.com)—affiliates of Hubbell Inc. (www.hubbell.com)—have acquired Connector Manufacturing Co. (CMC, www.cmclugs.com) and Canadian Connector Corp. (CCC), respectively, and their Barfield products brand,” writes Nick Moraitis, CMC vice-president, sales & marketing, in a letter to customers.

“CMC and CCC will be subsidiaries of Burndy LLC and Burndy Canada Inc., and part of the Hubbell Connectors, Grounding and Tooling Group (HCGT),” continues Moraitis. “We at CMC are very happy and excited to become a part of the Hubbell organization. We have joined a company that is a market leader with strong financial performance, and shares our values for superior customer service and investment in leading product technology and innovation.”

Moraitis explains the acquisition will be virtually seamless for customers. “CMC sales, service, support contacts and processes remain unchanged, so you can use the same communication channels and methods you currently use.”

RECALL - Impact injury hazards with Genlyte Capri track lighting

PHOTO COURTESY CPSC.



The U.S. Consumer Product Safety Commission (CPSC, saferproducts.gov) has announced Genlyte is recalling about 80,300 track lighting units over the concern that light fixtures can fall off of the track rail, posing an impact injury hazard to bystanders.

At this time, Genlyte has received 12 reports of the light fixtures cracking, including three reports of light fixtures falling off of their track rails. No injuries have been reported.

This recall involves Capri track lighting used in commercial buildings and includes 15 styles of metal or polycarbonate light fixtures, accessories and adapters. The track and light fixtures were sold in white, black or silver colors. A complete list of catalogue numbers and date codes included in this recall is at www.recall.philips.com. The catalogue number and date code are printed inside the lighting fixture. “Capri Lighting” is printed on a white label inside the track rail.

Consumers should stop using the recalled track lights, remove them from the track rail and contact Genlyte for free replacement track lights at (800) 375-6007 from 9 a.m. to 5 p.m. ET Monday through Friday, or online at www.recall.philips.com, choose United States/English and click on the Capri track lighting recall for more information or email the firm at caprtrack@philips.com.

The affected units were sold at electrical wholesale supply distributors from August 2010 through January 2013.

Innovation Advisory Council established for Industry Data Warehouse



The Industry Data Exchange Association Inc. (IDEA, www.idea-esolutions.com) has established an Innovation Advisory Council comprising “thought leaders” in the electrical wholesale distribution space from distributor and manufacturer companies. The council’s initial focus is on ways to enhance manufacturer product content available to distributors through the Industry Data Warehouse (IDW).

“The top priority for the council is to guide the enhancement of the product content in the IDW based on what our customers have identified as their most important needs in the growing digital economy,” said Bob Gaylord, president and CEO, IDEA.

As part of the “Innovating for the Future Plan”, IDEA will work with the Innovation Advisory Council to determine the best ways to deliver additional product information through the IDW that will enable more efficient bids, sales transactions and eCommerce capabilities for distributors.

IDEA was founded in 1998 through a partnership between the National Electrical Manufacturers Association (NEMA) and National Association of Electrical Distributors (NAED) members.

Electrical College of Canada launches new facility, celebrates 5th anniversary

Celebrating its 5th anniversary this year, the Electrical College of Canada officially launched its new, 7800-sf electrical educational facility at 90 Trowers Road in Woodbridge, Ont. (www.electricalcollege.ca). Ralph Cerasuolo, the college’s founder, was joined by the City of Vaughan’s mayor Maurizio Bevilacqua to officially open the facility.

“I am pleased to offer my sincere congratulations to the Electrical College of Canada for their commitment to skills development and education in the electrical trades,” said Bevilacqua. “I want to thank the Electrical College of Canada for their commitment to educating students to achieve their full potential.”

Ralph Cerasuolo, a Master Electrician, has been managing his family’s electrical contracting business (Neutron Electrical) for 15 years. The college he launched has been approved as a vocational program under the Private Career Colleges Act.

“After five years of training electrical students,



we have definitely created a niche for our specific expertise in electrical trade education,” said Cerasuolo. “The demand for electricians, and the success of our trade educational program, has allowed us the opportunity to expand and relocate.”

The college offers Construction and Maintenance Electrician Technician: Pre-apprenticeship programs, as well as a Certificate of Qualification pre-exam course to prepare candidates for the exam.

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Honeywell launches new LED Lighting Solutions business



Honeywell (www.honeywell.com) says its newly formed LED Lighting Solutions business (lightingsolutions.honeywell.com)—will offer a line of high-efficiency industrial LED lighting fixtures in North America, expanding Honeywell’s portfolio of energy efficiency products and solutions, and offering customers a “significant new source of energy and operational savings”.

“Our new LED Lighting Solutions business broadens Honeywell’s energy efficiency portfolio and offers a strong retrofit opportunity with building owners looking to maximize efficiency and operational savings,” said Beth Wozniak, president of Honeywell Environmental and Combustion Controls (ECC).

First Canadian-made Siemens wind turbine blade shipped from Tillsonburg

Siemens (www.siemens.ca) has officially shipped its first Made-in-Canada wind turbine blade from its manufacturing facility in Tillsonburg, Ont. After a send-off from employees, the 49-m blade left the plant and made its way along area highways to Chatham-Kent, where it will be used in the commissioning of the South Kent Wind project.

This first blade is one of 372 blades to be employed in the commissioning of 124 SWT-2.3-101 wind turbines at South Kent Wind as part of the 270MW agreement between Siemens and Samsung Renewable Energy Inc. and Pattern Energy Group LP.

Siemens says the blade production ramp-up highlights the positive impact the Green Energy Investment Agreement (GEIA) has made on manufacturing in Ontario. The 253,000-sf Tillsonburg plant was a former Magna International location that originally opened in 1975 and had been vacant since 2008. The

building was overhauled in 2010 by Siemens to set up its home of turbine blade production, which currently houses more than 200 employees.

Conergy Americas insists it's not affected by parent's insolvency

Conergy Americas (www.conergy.ca), the North American subsidiary of Conergy AG, says it will continue to

operate business at full capacity following its parent company’s decision to file an application for open insolvency in Germany on July 5.

“Our primary focus is to ensure that all of our projects are implemented, warranties are honoured and customer relationships are maintained,” said Jared Donald, president of Conergy Canada. **EB**



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Phil Flemming

It is with sadness that Electrical Business announces the passing of **Phil Flemming**, first district international vice president representing Canadian members of the **International Brotherhood of Electrical Workers** (IBEW, www.ibew.org), on May 25 at the age of 68. Flemming's career

began as an apprentice in Prince Edward Island, where he became a licensed electrician four years later. He

served as a business manager for the P.E.I. Local Union of the IBEW from 1975-1981, and then served as an international representative from 1981-1999. He then served as the executive assistant to the international vice president until 2003 when he became the international vice president. **Doug McKay**, Local 258 business manager, said, "Brother Flemming was a well respected leader in our Brotherhood. He served our membership with skill and strength and represented the IBEW as a strong organization on the national level."



Ulrich Spiesshofer

ABB has appointed **Ulrich Spiesshofer**, head of its Discrete Automation and Motion (DM) division, as CEO, where he will succeed **Joe Hogan** beginning September 15.

Hogan will continue with ABB for some months as senior advisor to the board, said the company. Spiesshofer joined ABB's executive committee in 2005 and was named responsible for DM in 2009. "ABB has developed a strong bench of talent. I am extremely pleased that the new CEO comes from within the company, and brings a solid track record and deep knowledge of the portfolio," said ABB chair **Hubertus von Grünberg**.

Ontario Power Generation (OPG, www.opg.com) says its commitment to nuclear safety and emergency preparedness was recently recognized by the World Association of Nuclear Operators (WANO) as **Fred Dermarkar**, OPG VP of engineering strategy, was named the recipient of the Nuclear Excellence Award for OPG's contributions to the overall WANO Post-Fukushima Response. The OPG Fukushima Response Project was established in 2011 to ensure adequate safety and accident management processes were in place, and to share industry lessons learned. The award recognizes OPG's work in risk and safety management in the Canadian and international nuclear programs. "The nuclear industry is constantly learning and adapting to enhance safety. Fred embodies this behaviour and works every day to make us better," said **Tom Mitchell**, OPG president and CEO.

Federal minister **Diane Finley** congratulated the Canadian participants and medalists of the recent **WorldSkills** Competition (www.worldskills.org), saying "Skills competitions are an exceptional showcase for talented young competitors, and they inspire other young people to explore careers in these high-demand fields". WorldSkills showcases the abilities of skilled young workers from around the world in various trades, technology and service industries. **Skills Canada** (www.skillsCanada.com) coordinates annual skills competitions, then selects and prepares competitors for the global competition. The 44th WorldSkills is August 2015 in Brazil. **EB**

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Readers weigh in on unlicensed electrical contractors...



Stock photo

Back in June, we published a news item entitled “Chelmsford contractor convicted and fined for non-legit electrical work” at EBMag.com (tinyurl.com/m9s4sw5), and it garnered a lot of attention. Below are some of the responses we received. Meantime, feel free to comment any time on anything we publish online (directly at EBMag.com) or in print (email EBMag’s editor at acapkun@annexweb.com).

✉ **Bring these contractors into the fold of legitimacy**

At least once a week I see a number of individuals loading up conduit, AC90, loomex and various boxes into their lettered and unlettered vehicles. Many of the lettered vehicles loading up PVC conduit are carpentry and landscaping companies. The unlettered vehicles are almost always vehicles being utilized for property maintenance, drywall, carpentry and so on.

This problem seems to be huge in the

Greater Toronto Area and Barrie area especially. If there were ever an investigator able to follow up on these illegitimate contractors, what a windfall of fines for the province!

It is sad, really, because while the entrepreneurial spirit is alive and well in Ontario, it is unwise to work outside the law. I believe the province has to do a better job of bringing these contractors into the fold of legitimacy on principle rather than through a heavy hand. Until then many will still try to beat the odds of getting caught, and experience the pain of massive fines.

— *Jim A.*

✉ **Time to catch up with these trunk slammers**

It’s about time someone caught up with all these trunk slammers, unqualified people and relatives. Why can’t we stop issuing ESA permits to people who aren’t registered electrical contractors?

It’s time to do this for a lot of reasons, but safety being the biggest! How much is a life worth... a case of beer?!

Sudbury is a hotbed of people doing electrical work under the radar; thanks for fining one. There’s lots more. Go get them!

— *Larry B.*

✉ **We have to be part of the solution**

I have seen far too many examples of shoddy and hazardous work done by these jack-of-all-trades and masters of none. It is high time that we, as responsible licensed contractors, took the time to report these instances as we see them to the ESA. We can complain all we want, but we have to be part of the solution. I know for a fact that ESA will follow up and prosecute these cases.

Also, by publishing these cases in places where people will see them (e.g. internet and other news media), the public—as well as the violators—will realize there are consequences for doing electrical work without proper licensing.

— *John F.*

✉ **Call it as we see it**

We call in these hazards (illegal installations) regularly; not only residential, but commercial, as well. We are fortunate to have the ESA, ECRA licensing and the permit process in place in Ontario. Even so, more enforcement is needed. Our industry suffers because handymen do our work at cut-rate pricing while legitimate contractors have reduced work-weeks or layoffs.

Only a TSSA-certified contractor can purchase gas fittings at a wholesaler, so why can anyone purchase electrical products from electrical wholesalers and box stores and walk out with the product? There is no process in place to ensure that the installation is by anyone qualified.

I would like to see the sale of electrical products regulated at the point of sale and the individual purchasing the product provide either proof of an ECRA license or, for homeowners, information that is forwarded to ESA. For ECRA-licensed contractors, our suppliers know who we are, but for the homeowner or handyman, they are now liable for products they purchase, and many will probably leave the product with the cashier and walk out.

Meantime, for all of us: keep doing it right, and keep calling them in whenever we see them.

— *Brian W.*

✉ **Stop selling and stop possession**

If they don’t have access to the materials, they can’t perform the work. The law has to change. Everyone has to stop selling electrical materials to the general public.

No licence? No material! And, by the way, no ESA inspection number, no material.

Caught with electrical material in your possession and no authorization to possess it? Jail time for you.

We need to start treat wiring materials like illegal narcotics, because bad wiring is just as devastating to the public’s well-being as illegal drugs.

— *Leonard F. EB*

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In the film "Dead Poets' Society", Robin Williams plays a gifted and dedicated teacher determined to help his students appreciate the age-old adage of *carpe diem* (seize the day). This phrase captures a major theme both in the film and in life: make the most of your existence, and don't let opportunities pass you by.

Keeping this advice in mind, many ambitious business managers have decided to seize the day by making the transition from employee to employer. For several of these individuals, the best way of accomplishing this is by initiating a management-led buyout and takeover of the companies for which they work.

Being an entrepreneur is not for the faint of heart. What separates them from dreamers is their ability as individuals to invest somewhere in the vicinity of \$250,000 into the companies they hope to own. This number can be as high as \$1 million in some larger deals. When you want to own something, you have to put your money—and likely your job—at risk. If you are unable to put your money on the table, stop dreaming.

A substantial financial investment is critical for a serious management buyout because outside investors (institutional or private) need to know you are committed. Investors who will personally support a management team or make a company investment are almost always required and strongly recommended. Institutional investors request private investors that have some management background or special knowledge in the industry to co-invest with them. Institutions refer to these investors as the 'smart money'; should something go wrong or an important decision have to be made, the institutional investor wants to have some other, 'sophisticated' investors as part of the deal to help them work out the issues.

To ensure the success of a leveraged acquisition, it is extremely important to establish an appropriate capital structure. You will need to understand and present your written business plan detailing seasonality, cash flow cycles, capital expenditure requirements and other such factors.

Some preferences presented by lenders when financing a buyout include:

- Companies that are not highly cyclical and have steady, predictable cash flows
- Companies with low capital expenditure requirements and high free cash flow

- Growth businesses, especially in high valued-added manufacturing
- Companies with strong, committed management teams and well-communicated, compelling business plans.

Meeting these requirements can be a challenge for company employees, managers or executives.

Management buyout opportunities present themselves often and for a number of different reasons. The first and most common reason is that a company or division no longer fits within the strategic aims of the parent group or owner. Another reason may be that the parent group or owner simply requires liquidity or cash. Or, profit levels may not be considered acceptable, or the company is showing a loss.

Other reasons include a private owner who wants to sell his business and not bother with the complicated process of selling to an outside buyer. Usually, this seller has a very good relationship with the management team and has confidence in their ability to manage the business. This type of owner usually retains some equity ownership or assists in financing the business with vendor take-back notes.

Management-led buyouts are generally regarded with great favour as they provide corporations with a convenient alternative to the acquisition of their company by an outside suitor, while at the same time allowing them to avoid the conflicts that often arise between management and outside buyers.

The entrepreneurial spirit is alive and thriving in Canada. Before beginning, however, it is extremely important that management agree to a business arrangement among themselves (infighting is a major reason deals fall apart).

Never in history has there been more diverse, abundant and less-expensive investment capital available chasing too few deals as there is now. There is no excuse for talented management teams not to take hold of their future and at least attempt a management buyout. Seize the day! Use the opportunity of the present moment to pursue your vision. **EB**

Mark Borkowski is president of Toronto-based Mercantile Mergers & Acquisitions Corp., which specializes in the sale of mid-market companies. Acquisition search represents a portion of its activity. Visit him at www.mercantilemergersacquisitions.com.

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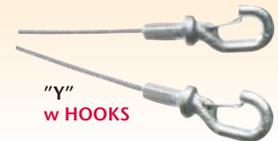
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DWB0815	15'
DWB0820	20'
DWB0830	30'

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CATALOG NUMBER	WIRE LENGTH
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DWYH0810	10'
DWY2H0810 (2 PK)	10'
DWYH0815	15'
DWYH0820	20'
DWYH0830	30'

"Y" w TOGGLES

CATALOG NUMBER	WIRE LENGTH
DWYT0805	5'
DWYT0810	10'
DWY2T0810 (2 PK)	10'
DWYT0815	15'
DWYT0820	20'
DWYT0830	30'



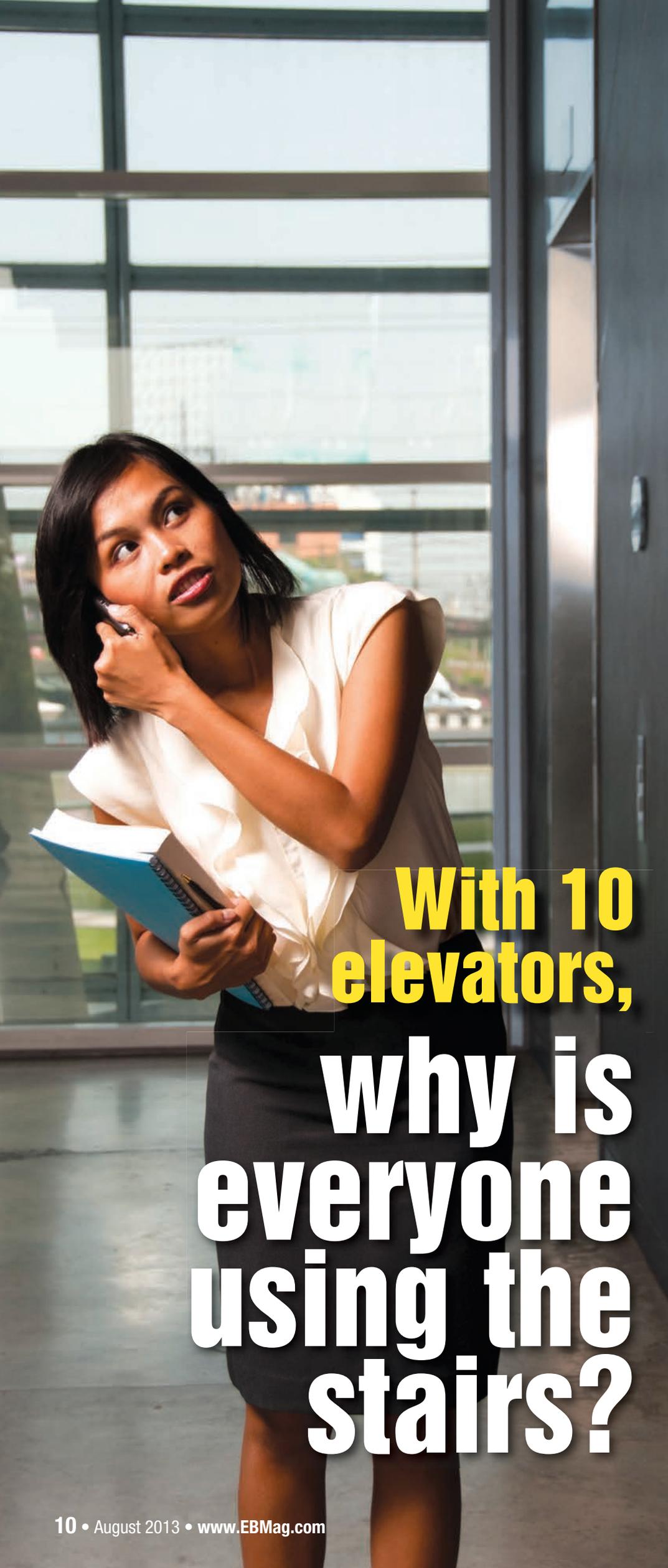
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With 10 elevators, why is everyone using the stairs?

Patrick J. Lynch, P.Eng.

There was a bank of 10 elevators in this building, but most everyone was using the stairs. It was a very strange site to see.

When we entered the main lobby of this 30-storey commercial building, the majority of the fully operational elevators were sitting idle at the lobby level with no passengers. The majority of people were using the stairs.

Maybe some sort of a corporate physical health edict had been declared?

We decided to take one of these elevators to our meeting on the 25th floor. We shared the car with several very reluctant and nervous passengers. Each one started to relate to us their terrifying experiences they had suffered at the hands of these elevator cars.

According to them, there was about a 1 in 5 chance the elevator car would malfunction. Nervous, semi-humorous bets were placed by these other passengers on whether our elevator trip all the way up to the 25th floor would be successful.

Thankfully, we made the trip to the meeting room on the 25th floor without any problems. At the meeting were the building owners, the major building tenant (Company X) and the elevator manufacturer, as well as their respective legal counsels.

Apparently, the intermittent problems with the elevators had been occurring ever since the building was first occupied, about a year earlier. As more tenants moved in, elevator use increased and the problems correspondingly increased.

Among the first major building tenants to arrive was Company X, which had leased six floors. Several of its employees had already been injured while riding in these elevator cars (e.g. broken arms, concussions, bruises and abrasions). On several occasions, the fire department had to be called to rescue trapped employees from these elevators.

Company X was in the process of suing everyone involved with this elevator car system. The building owners, in turn, were attempting to sue the electrical utility for delivering "bad power to the building", which supposedly caused these elevator systems to malfunction, as well as the elevator company for poor equipment performance (\$15-20 million dollars).

Two other investigative groups involved over the last six months were unsuccessful in solving these elevator problems. Our group had been brought in out of final desperation to sort out this mess and try to resolve the issues.

All parties at the meeting agreed to temporarily suspend their legal proceedings until we had finished our professional electrical forensic engineering investigation.

Preliminary findings

1. This newer elevator car technology system used a VFD (variable frequency drive) system to control the movement of each car.
2. Each time the elevator cars moved, there was a noticeable 11th harmonic ($11 \times 60 = 660\text{Hz}$) hum in the car, as well as on the corresponding steel cables supporting the cars.
3. Typical loss of control of the elevator car involved the car doors opening as the elevator hurtled up/down five to 10 floors to finally emergency crash stop at a random position in the elevator shaft.



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4. All elevator cars were equally involved in these intermittent death-defying plunges.

We immediately teamed up with the R&D elevator manager to tackle this problem. According to him, their software program did not even allow the cars to move until all doors are fully closed first. Yet, according to the field reports, these elevator cars were hurtling through space, bypassing all of their safety circuitry with doors open.

This simply did not make any sense at all... or did it?

After each elevator malfunction occurrence, the elevator would be locked out-of-service and full diagnostic testing scans would be performed on all software, hardware and elevator control circuitry. Each time the elevator system would check out as fully 100% operational, then put back into service... only to hurtle again through space some time later.

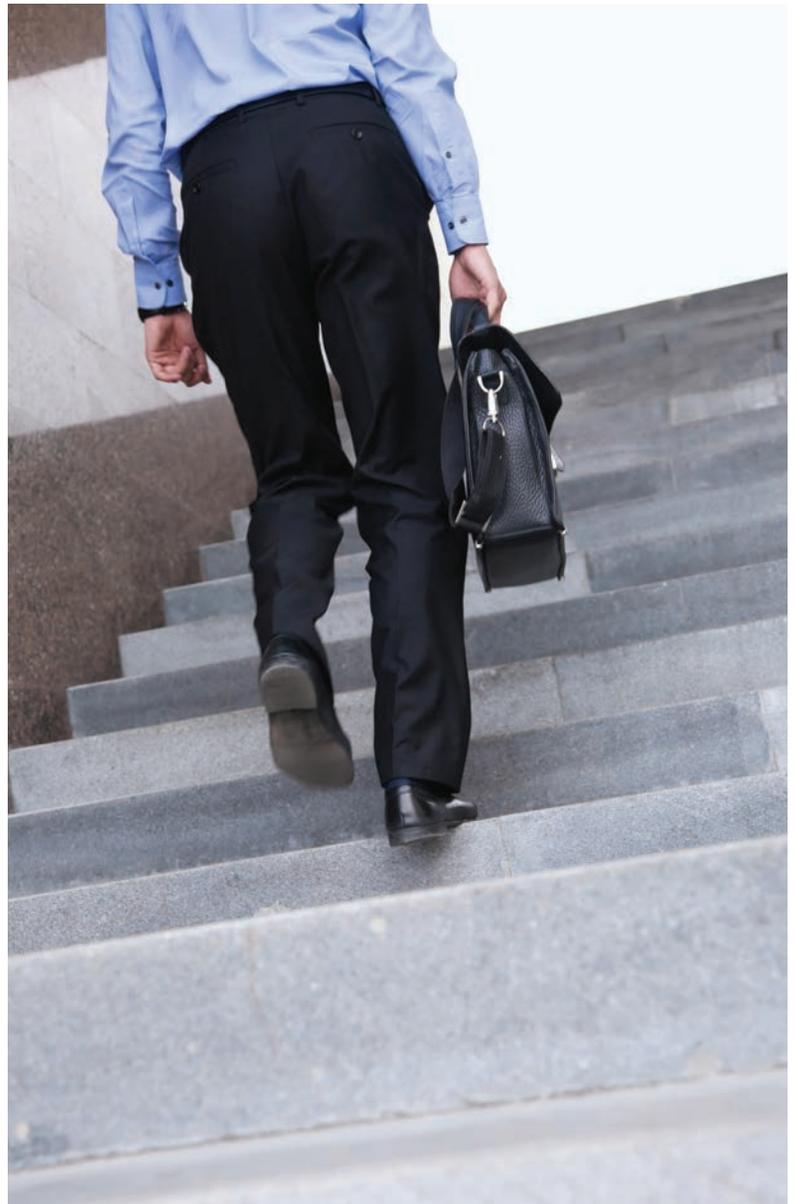
Whatever was causing this problem was intermittent, and would only temporarily corrupt the elevator car operational computer program, bypass all safety overrides then vanish, leaving no trace of where this corruption had entered this system.

We went into the main elevator room with the R&D manager. This room contains all the large VFD-controlled motors that control the cars via the steel cables, as well as a maze of hundreds of electrical contactors and microprocessors controlling the precise movement of each elevator car. The air in the entire room was filled with very fine, black carbon dust particles. Everything in the room was coated with this black soot.

The R&D manager plugged his laptop computer into one of the elevator microprocessors and demonstrated that all systems were performing their normal tasks with no alarm data present.

We asked to take one of the elevator cars out-of-service to probe the microprocessor's circuitry in greater detail. The microprocessor was working on 5V logic levels. We connected our equipment to the main 5V logic bus and observed this trace during the various elevator operations.

All of a sudden, a 1.8V spike appeared, 5- μ s long on this 5V bus. We cycled the elevator again and again; this same voltage spike appeared each



time on the 5V bus. With the elevator at a standstill, no voltage spike was generated. It was only generated while the elevator was moving. Through various control-isolating techniques, we were able to narrow the search down to one specific electrical contactor.

Each time this contactor operated, it injected this inductive 1.8 voltage spike via the common ground back onto the microprocessor circuitry ground. (The logic 0 shifts to a logic 1 level when this spike coincides with the leading edge of the logic shift. It then becomes a game of Russian Roulette; eventually, this microprocessor will be using corrupted data again.)

We installed a temporary RC snubber (resistor/capacitor) we had with us onto the field coil of this contactor. This rapidly rising voltage spike was no longer generated, and the microprocessor 5V bus was again 'clean'. The RC snubber suppressed this contactor-generated field coil voltage spike. The elevator manufacturer immediately ordered this retrofit solution to all elevators at this site, as well as at all of its other troubled elevator sites.

All elevators have now been working problem-free after this retrofit.

Outcome

The material cost to resolve this control issue with each elevator system: just \$30. The elevator control problem was quickly identified and solved in just one day, and multi-million dollar lawsuits were settled out of court.

As for the tenants, some had lost weight during these elevator problems but, after six months with all elevator systems working problem-free, the weight was regained. **EB**

Patrick J. Lynch, P.Eng., has been the president of Power Line Systems Engineering Inc. since 1986. He graduated Electrical Engineering from the University of Waterloo in 1975, and has successfully directed Power Line's completion of over 1100 complex electrical engineering site disturbance investigations around the globe. Visit www.powerlinesystems.ca.

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A GUIDE to selecting the right bearing seal



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Seals keep lubricant in and contaminants out

Thomas H. Bishop, P.Eng.

The primary functions of a bearing seal are to keep lubricant in the bearing and bearing chamber, and to exclude contaminants from that area. This article focuses on seals that are external to the bearing and, therefore, not part of the bearing itself.

Key factors in bearing seal selection include:

- Type of lubricant (oil or grease)
- Type of bearing (rolling or sleeve)
- Shaft surface speed, connection to load (e.g. direct-coupled or belted)
- Seal friction and consequent heating
- Physical space available

The types of seals most commonly used with rolling element (ball and roller) bearings are contact or lip seals (Figure 1), non-contact seals (Figures 2 and 6) and, to a much lesser degree, bearing isolators (Figure 3).

Contact seals

Contact seals create an effective barrier against fluids or solids particles by applying continuous pressure to the shaft surface with a resilient material. The drawback is they cause friction and heat that can degrade both the seals and the surface finish of the shaft.

Contact seals (or bearing isolators) should be used for oil-lubricated bearings except sleeve bearings, which commonly use non-contact labyrinth seals (more on this later). When a less-effective sealing method is acceptable, non-contact seals are an alternative.

Non-contact seals

Non-contact seals produce much less friction (if any) and heating than contact seals, but they may allow lubricant to leak from the bearing chamber, and liquid or physically small contaminants to enter. Because they may allow leakage, non-contact seals are not acceptable in most oil-lubricated applications. (Note that virtually all sleeve bearings are oil-lubricated, whereas most rolling element bearings are grease lubricated.)

Bearing isolator seals

Bearing isolator seals combine the features of contact and non-contact seals into a single unit, using the contact features to 'drive' part of the seal at shaft rotating speed. Bearing isolators can be used with either grease or oil lubrication, and with either sleeve or rolling element bearings. Although they are more costly and require more physical space, they provide more effective sealing than either a contact or



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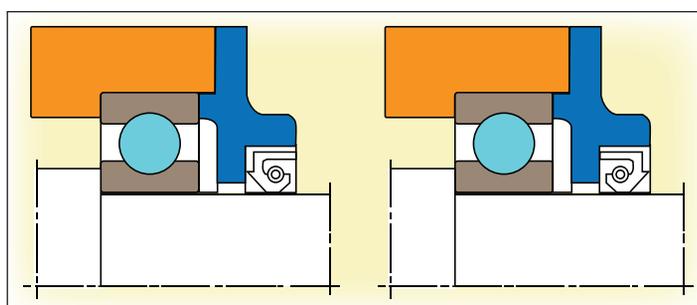


FIGURE 1

The contact grease seal arrangement on the left provides better protection against dust and liquids entering the bearing chamber; the arrangement on the right is better for retaining lubricant in the bearing chamber.

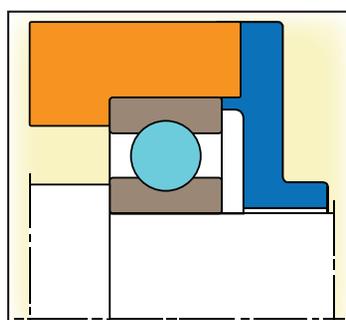


FIGURE 2

Example of a non-contact seal (in this case, used for a ball bearing).

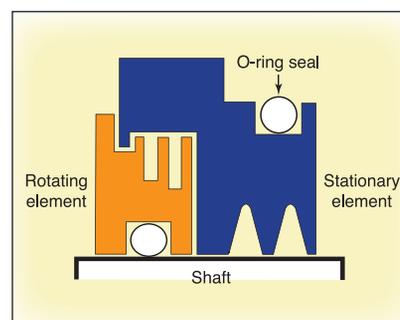


FIGURE 3

Example of a combination of contact and non-contact bearing isolator seal.

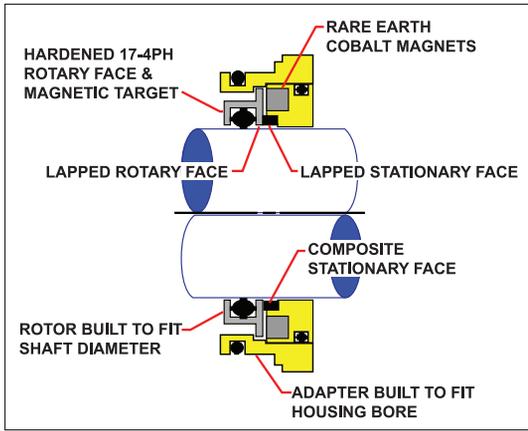


FIGURE 4
Contacting-type bearing isolator (courtesy of Iso-mag).

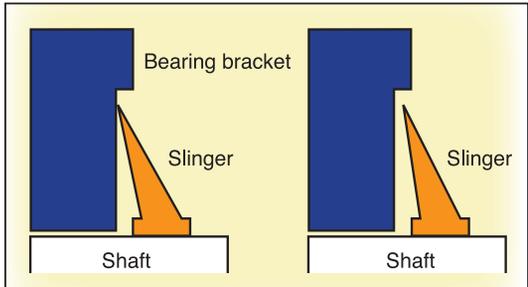


FIGURE 5
The shaft slinger seal: a combination of contact (left) and non-contact (right) seal types.

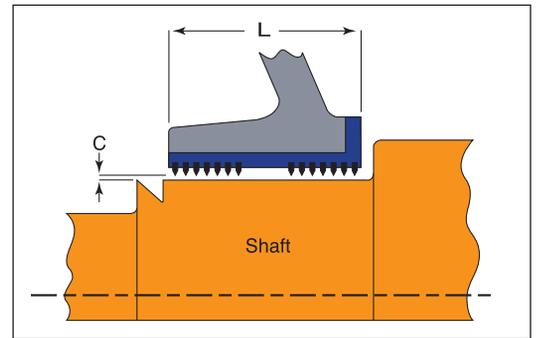
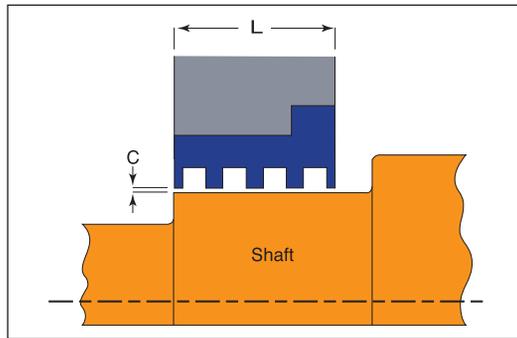
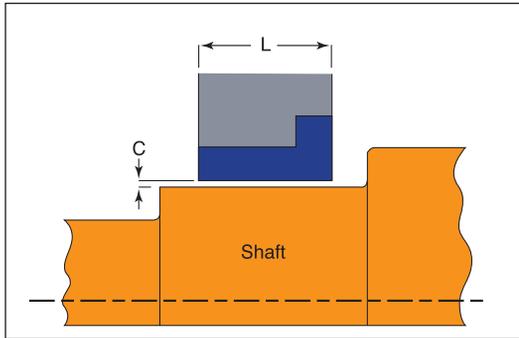


FIGURE 6. Non-contact seal labyrinth examples arranged in order of sealing effectiveness. Values for clearance (C) and length (L) are the same for each example.

non-contact seal used individually.

The first bearing isolators were non-contact labyrinth seals that greatly reduced contamination ingress but did not stop moisture or other vapours. A newer version is a contacting isolator (Figure 4) that uses rare earth magnets to apply tension to lapped contacting faces (like a mechanical pump seal). The contacting-type stops all solid and vapour contamination, but has a surface speed limitation of about 100 mm shaft diameter at 3600 rpm.

Another variation of bearing isolator is a labyrinth design with an O-ring or other elastomer element. The element seals the labyrinth channel when the shaft is at rest. During operation, the centrifugal force of the rotating shaft expands the element and opens the channel. This arrangement prevents vapour ingress when the shaft is stopped and eliminates friction/heat when it is turning. Special long-relief bearing isolators are required to accommodate the axial end float associated with sleeve bearings.

A 'shaft slinger' combines the features of contact and non-contact seals (Figure 5). It contacts the end bracket when the shaft is idle and moves away from the end bracket due to centrifugal force when the shaft is rotating.

The other type of non-contact seal commonly used is the labyrinth seal (Figure 6). It can be used with rolling element or sleeve bearings, and with oil or grease lubrication.

Suggested oil-lubricated sleeve bearing labyrinth clearances are given in Table 1. Regarding diametral clearances for grease-lubricated rolling bearings, one source suggests about 0.04 to 0.08 mm/cm for shaft diameters below 50 mm, and about 0.05 to 0.10 mm/cm for shafts 50 mm and larger.

Shaft surface speed must be considered for contact seals. Excessive speed will degrade the seal material due to overheating from friction, and may damage the shaft surface. Table 2 provides limiting speeds for some common contact seal materials. Contact seal friction and wear are also affected by shaft surface finish. Suggested shaft surface finish tolerances are given in Table 3. 

Thomas H. Bishop, P.Eng., is a senior technical support specialist at the Electrical Apparatus Service Association (EASA), an international trade association of more than 1900 firms in 58 countries that sell and service electrical, electronic and mechanical apparatus. Visit www.easa.com.

TABLE 1: Labyrinth seal diametral clearance guide

DIMENSIONS IN MILLIMETERS					
Shaft Diameter* 3000 to 3600 rpm		Diametral Clearance**	Shaft Diameter* 1800 rpm or lower		Diametral Clearance**
From	Up To	(+.050mm/-.000mm)	From	Up To	(+.050mm/-.000mm)
76	89	0.230	76	89	0.305
89	102	0.255	89	102	0.355
102	114	0.305	102	114	0.405
114	127	0.355	114	127	0.455
127	140	0.380	127	140	0.510
140	152	0.430	140	152	0.560
152	165	0.455	152	165	0.610
165	178	0.510	165	178	0.660
178	191	0.535	178	191	0.710

* The shaft diameter is the diameter at the seal fit; and 'up to' means 'up to but not including'.
** The diametral clearance is the clearance for the applicable range of shaft diameter.

Speeds given are synchronous speeds corresponding to the applicable line frequency and electric motor winding poles. Dimensions shown in millimetres are rounded off. The above table is to be used for horizontal machines with bronze/brass labyrinth seals, absent specific clearance recommendations from the manufacturer. Galling materials, such as cast iron, may require greater clearance. Vertical machines may require less clearance. Labyrinth seal clearance must always be greater than the bearing clearance. A general rule of thumb suggests labyrinth seal clearance should be 0.050 to 0.100 mm greater than the sleeve bearing clearance.

TABLE 2: Limiting surface contact speeds for seal materials

Seal material/type	Limiting speed (m/sec)
Felt	4
Grease seal	6
Oil seal, nitrile rubber	15
Oil seal, fluorinated rubber	32
V-ring	40

TABLE 3: Shaft surface finish tolerances

Circumferential speed (m/sec)		
Over	Up to and including	Surface roughness Ra μ m
0	5	0.8
5	10	0.4

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Maintenance-driven safety

Part 1 of 2

By now, most of you know I choose to live in my hometown of Turtleford, Sask., population 500. I started my company in 1980 in Calgary but, for family reasons, relocated to Turtleford in 1995. And, just like Dog River, if you haven't heard a rumour by 10 am, you start one!

As in any small town, it's easy to be a hero... but you're lucky if it lasts for 15 minutes. A number of years ago, the scoreboard went down at the community centre while I was out of town, and people were becoming frantic at the cost of buying a new one. The arena manager called me, and I said, "Get the control boards out, and let's look at them when I get back".

When we looked at the control boards, I could see some burned diodes and a suspicious transistor. With just \$5-worth of parts and some soldering, we had the scoreboard going again.

I was just at a facility where one of the electrical trainers showed me a control box that had been sent to him from the field, with the urgent request to send back his training control box to be installed. He showed me the burnt resistor and some smoked electronic parts in the one from the field; again, for a few dollars' worth of parts and some soldering, the unit that was frantically shipped from the field because it could neither be diagnosed nor repaired was put back into action in the training department.

But why, you may ask, is this information in an electrical safety column? The fact is we depend on our systems to provide a significant amount of protection, and maintaining them effectively is directly related to our human safety.

When I asked a crew doing infrared scans on switchgear whether they were going to scan their printed circuit boards, they looked at me as though I had just landed from Mars. I²R losses cause system failures as easily in PC boards as they do in bus work; not as dramatically, but certainly as effectively, and an IR camera will detect this and other problems. Many PC boards are difficult to access, but many are easily scanned with an infrared camera. This technology should not be restricted to only high-current concerns; they can be used anywhere there is heat.

IR cameras are now common in industry, with many large facilities having them in each of their departments. With such popularity, the prices have dropped dramatically while usability has increased substantially. I have had many non-electrical managers express great pride in the thoroughness of their electrical maintenance program because they conduct regular IR scans.

But while IR detects, there are also serious

With these standards came the ugly realization that adopting and implementing these safety standards means very little when an electrical system is not properly maintained. Hence, CSA Z463.

problems to which the technology is blind. For example, at 2.4kV and above, corona and partial discharge will slowly destroy insulation, and these problems require different detection methods. When they go undetected, explosions and injuries can result.

There are a host of specialty tests that can be done on electrical systems, but they are restricted by knowledge, commitment and budgets.

Our new Canadian maintenance standard, CSA Z463 "Guideline on Maintenance of Electrical Systems", will be soon published. Our national team of experts began working on this in March 2011, and we just had our final meeting and voting in June.

The need for this standard became apparent with the advent and roll out of CSA Z462 "Workplace Electrical Safety", which was borne in 2008 out of its American counterpart, NFPA 70E "Standard for Electrical Safety in the Workplace", which had been broadly adopted by Canadian industry.

These standards both became necessary after decades of electrical incidents killed or permanently disabled workers, and it became overwhelmingly obvious that policies, standards, procedures, practices and PPE (personal protective equipment) needed to be adopted and used.

With these standards came the ugly realization that adopting and implementing these safety standards means very little when an electrical system is not properly maintained. Hence, CSA Z463.

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 dav-smith@canada-training-group.ca. At www.canada-training-group.ca, you will find this article (and others) to help support your own safety initiatives.

Add speed and accuracy with estimating software

Todd McCormick



In the decade that began with 2010, nothing seems to come easy for electrical and datacom contractors, and others in construction: there seems to be a reduced amount of work in many places or, to put it another way, there's much more competition for what there is out there.

Why, then, does this article put forward the idea that you, the contractor, need to invest more in your company by adopting professional estimating software? Let's share certain basic assumptions:

1. You are bidding on more potential work than ever before; not because there's more work to be had, but because you are driven by the need to bring projects into your company. There's less negotiated work available now and, where previously you might have confronted eight or 12 bidders on a typical job, you are now seeing 25 or more. Your hit rate is just not very good (and it probably shouldn't be!). Although you hope things get better in your area as the economy improves, hope is not a good business plan.
2. To bid more work, you work harder and later. Whereas before you may have bid five or seven jobs a week, it is hard to find ways to save time in bidding 16 jobs a week when you work on paper. There may be some minor time savings when you use a computer spreadsheet (save a bit of time when doing the extensions) provided you've got all of the formulas inputted correctly, but submitting more bids still means late nights and weekend work, too.
3. Let's get away from the estimate for a minute; you probably haven't added estimating personnel in the past two or three years. Submitting more bids—perhaps a lot more than in, say, 2007—means more physical and psychological wear-and-tear on you and/or your estimators. Without meaning to, you've created the



potential for more mistakes. Many contractors these days have come to fear becoming the winning bid... what did they omit from the job that the other bids included?

4. Speedier estimating would be welcome, of course, as it would enable you to pursue additional projects without late nights and weekend work, but all of us who work in construction know that speed can kill. You've got to have a way of estimating that is simple but accurate. Should you get faster but simultaneously lose the handle on accuracy, well... you'll soon be out of business.
5. Depending on when you last looked at adding software to your operation, you might be ignoring advances in recent years that will provide advantages to your operation.

Moving up to estimating software

I'm from a company that has been in the estimating and project management software business since 1979, but this article isn't about my company nor an argument as to why you should buy from us. We have competitors, and there are products in the marketplace that do not have my family name on them that can help you.

What's encouraging is what we hear from our customers, such as cabling contractors who switched from spreadsheets to professional

estimating software that added capabilities some didn't know existed. Long-time users of our system who upgrade in certain areas report the expense paid for itself in less than two to three months in time savings.

One important point: while all software is not the same, the graphical user interface (GUI) ends up being pretty much the same thing. Microsoft Word, to choose something with which most of us are familiar, is on many millions of computers, yet the average user uses of perhaps 8% to 10% of the software's functionality.

And there's nothing wrong with that but, when it comes to professional estimating software, contractors and estimators who gain a better handle over time on exactly what they have on their desks end up the most satisfied. Essentially, computerized estimating software is nothing more than a tool, albeit a tool with a lot of great functions and facets.

Estimating professionally

At heart, your company's product is a service—the ability to help build a new building, or to upgrade it electrically or datacom-wise, or to service/maintain it. The estimate is your roadmap to success.

Invariably, you'll estimate the job to develop your price, and there are several gains when doing the estimate via professional software, including:

A. You'll adapt your method of estimating to the computer's capabilities. However, you probably already have a way of tackling a project, and flexible software can easily be adapted to match the way you go about doing that.

B. You'll probably pursue specific types of work. Even when you do not specialize, you find yourself doing some similar types of installations. With professional estimating software, you'll find it a snap to create assemblies that you can use over and over.

C. Most professional estimating software will come with a product database. You'll customize this over time, adding products as needed. This won't be speedy the first time you do it, but it will save time, add accuracy and accelerate your estimating process over time.

D. There are advantages to getting the take-off and basic estimate done as fast as possible, which is something professional estimating software enables. Sure, you can estimate more jobs in the same time but, alternatively, once you have the basics of a given project in the



computer, you (contractor or estimator) can sit back and think about the job... perhaps come up with alternative ways to build the project that will make your bid smarter than what others have submitted.

E. Once you become comfortable with the basic process of estimating via software, you'll start thinking about the software's additional capabilities. In our case, we get questions about using the estimate to create a project schedule, for example, or how to use it in creating a presentation.

Computerized take-offs

One relatively recent improvement in the marketplace has been the ability to do take-offs on your computer. Actually, an early first of this—CAD Estimating—won an award at the annual NECA Show back in 1999, and it's not a difficult idea to get your head around:

- You get a CAD drawing from the architect or engineer, complete with electrical symbols.
- On your computer, the CAD estimating software does an automated take-off, and (when it's done) makes sure any unidentified symbols (thus not included) are called to your attention.
- You identify those symbols for the software.

Result: you have an accurate count of the products in the job, the number of runs, lengths of wire needed, etc.

Sounds wonderful? It can be. Unfortunately, a hurdle remains in the way: design-level concerns about alterations to CAD drawings. This makes it difficult for contractors to get CAD files for most projects.

My company found an existing solution: OnScreen Take-Off (OST), which can work on GIF, PDF or DWG files and provide accurate counts. It takes some work for a contractor or estimator to teach the system the meaning of the symbols but, once you do that, it is set for the future.

But my company is not alone in this. There are other options.

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There's much more

There's more out there for your company. Computerized price updating is available direct from electrical distributors and other sources; you do the estimate, nail down the product list, and get up-to-date prices (quickly and automatically) drawn right into your estimate.

Where just a few years ago you might have seen limitations, today you will see opportunities. Larger companies can have several estimators working on the same

project—even when they are not in the same location—with real-time updates. The estimating software can be used on the jobsite as well as in the office.

Indeed, there's even more: time-and-material billing; using the estimate for project management; post-project calibration of your estimate with what happened in the field; expanding use of the software from electrical to datacom and/or automated building systems work.

What's the point? Companies like mine have products that can make estimating less of an ordeal. Professional estimating software might not give you the lowest prices in town; but it will enable you to reshape the process of getting through both difficult and boom periods. **EB**

Todd McCormick is president of McCormick Systems (www.mccormicksys.com), which provides estimating and project management software for electrical and other construction contractors.

By-hand estimating classes... from a technology vendor?

You may be surprised to learn that McCormick Systems—a software and technology company—conducts classes on the basics of estimating. The "By-Hand Estimating" class teaches students how to estimate an electrical job... on paper!

But this is not an advertisement for these classes, which are all about understanding and using basic estimating concepts... all without the aid of computers.

Often, a contracting firm will consider a specific field electrician as a promising future estimator. But will that person, who has never done an estimate, like the work that's involved? Two days spent estimating a project on paper will help provide a look at the skills needed, and allow the candidate to see what life is like away from the jobsite.

Further, many construction companies are family owned. Sometimes, members of the owning family are brought in to the operation (either from the field or from an unrelated occupation). Estimating and bidding jobs make up key overhead tasks. How does one learn about the elemental tasks and thinking that are involved?

What we hear from students after a typical two-day class—again, no computers—are statements such as "There is a lot more to this than I ever imagined". Some say they learned that estimating is something they do not want to do in the future, while others say they like it and wish to pursue a career.

After more than three decades in the business, our company has seen contractors take people who know nothing about electrical work—even some who have never worked out in the field—and turn them into junior estimators. We've also seen veteran electricians, who perhaps can no longer handle the daily physical wear-and-tear of field work, brought into the office and converted into estimators.

By no means will a two-day course produce a ready-to-go estimator, but it can provide the paper-and-pencil basics of estimating—the hows and the whys—and help you screen candidates for those with an aptitude for the work. **EB**

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Cree releases CPY250 LED canopy/soffit series

The new LED canopy and soffit lighting series from Cree—CPY250—claims to set a new performance standard with 35% improved performance to competing LED luminaires, quick and easy installation and lower total cost of ownership. The series also claims to consume 75% less energy than traditional metal halide systems. Available in both flat and prismatic



drop lens, the CPY250 provides two illumination aesthetics to meet the visual, as well as the vertical and horizontal illumination performance needs of a typical canopy application, says Cree. It can be mounted to a canopy deck and is secured in place with self-sealing screws.

CREE

www.cree.com/lighting

LSG Coastal Light features amber-coloured LEDs



Lighting Science Group announced the release of the outdoor Coastal Light, designed with amber-coloured LEDs to help deter sea turtle hatchlings and other wildlife that are sensitive or threatened by unnatural nighttime light sources. Studies show that wavelengths in the ultra-violet, blue, or green spectrum are most disruptive to turtles. LSG also presents the Coastal Light as a solution to bright, disruptive beach illumination. The lamp is available in a variety of configurations and mountings, and offers optional full cutoff shielding attachable in the field without tools.

LIGHTING SCIENCE GROUP

www.lsgc.com

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Control4 has introduced the Control4 wired keypads along with the availability of its new Control4 panelized lighting solution, designed to provide one-touch control of lighting, security, HVAC and entertainment. Supporting 110V-277V applications, the Control4 panelized lighting solution is suitable for both residential installations and commercial environments. Dealers have the ability to pop in keycaps to create multi-button keypads of varying configurations to personalize the functionality and design that best aligns with their customers' needs. The new 8-channel, Control4 Adaptive Phase Dimmer module includes automatic phase control technology to support: dimmable LED, CFL, fluorescent, incandescent, halogen and low voltage.

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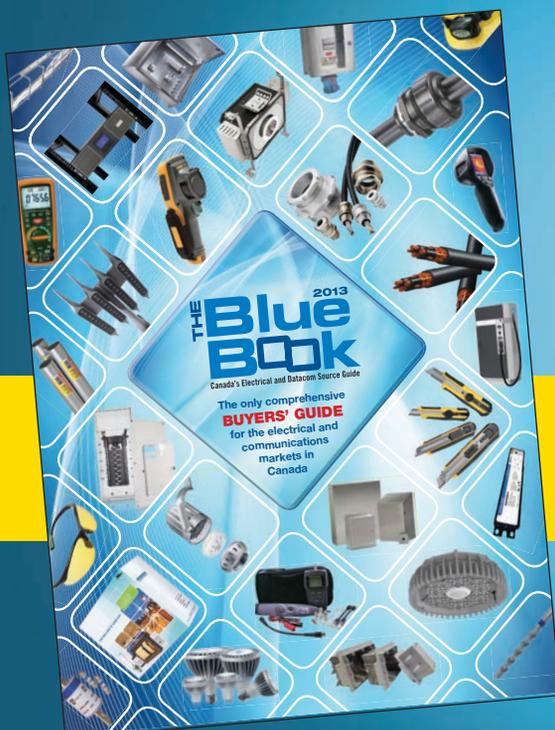
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What is effective grounding?

The Canadian Electrical Code's long-winded definition of grounding is:

a permanent and conductive path to the earth with sufficient ampacity to carry any fault current liable to be imposed on it, and of sufficiently low impedance to limit the voltage rise above ground and to facilitate the operation of the protective devices in the circuit.

As you no doubt noticed, the definition covers a lot of ground (pardon the pun), as it includes all of the electrical code requirements, including that grounding must:

- Be permanent and continuous
- Carry available fault currents without failure
- Have sufficiently low impedance to ensure that voltage rise during a ground fault will not cause damage to components, such as sensitive electronic devices
- Ensure fuses and circuit breakers react quickly enough to prevent electrical failures, fires and shock hazards

In some cases, the code does not require all electrical circuits be solidly grounded; in others, the code outright prohibits it.

Rule 10-108 specifies that circuits supplying

electrical arc furnaces (e.g. scrap metal melting furnace) need not be grounded. Rule 10-110 specifies that circuits supplying cranes operating above highly flammable fibers in Class III hazardous locations must not be grounded. This provision reduces the probability of arcs and sparks along the crane rails and the current collector, thereby limiting the risk of a flash fire.

Rule 10-112 permits ungrounded circuits supplied by a transformer incorporating a grounded faraday shield between the primary and secondary windings when permitted by other rules, or in special cases to prevent electrical accidents (underwater swimming pool speakers, for example).

We are all at ease with solidly grounded electrical systems; they provide the benefit of limiting system voltages to ground and minimizing voltage stress on wiring and electrical equipment insulation. Solidly grounded systems may experience high ground fault currents but, when correctly arranged, faults are quickly detected and removed by fuses or circuit breakers before any damage.

In an industrial environment, shutting down during a ground fault may be impracticable and, as such, other grounding methods are recognized in the code. Rule 10-106(1) requires that, except where otherwise specified, 120/240V

and 120/208V AC systems or circuits that include a neutral conductor must be grounded.

Ungrounded delta systems don't require shutting down during a single-phase ground fault since they have no reference to earth. However they come with risk of equipment damage as well as personal safety risks when a second phase becomes inadvertently grounded. In addition, overvoltages tend to shorten the lives of electrical equipment. Rule 10-106(2) requires that ungrounded delta systems must be equipped with ground fault detection devices such as ground indicating lights to ensure that inadvertent grounds are removed as quickly as possible. But you know what happens to those: the indicating lights burn out and are not promptly replaced, leaving people and equipment at risk.

A nice compromise is resistance grounding, which permits operation during a single-phase ground fault. It offers a number of important advantages: resistance grounding limits ground fault currents by connecting a grounding resistor between the electrical system neutral and the system ground electrode, thereby:

- minimizing damage to electrical wiring and equipment
- reducing mechanical stresses
- reducing arc flash and blast hazards
- controlling overvoltages, and
- not requiring shutdown during a ground fault

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

Tackle The Code Conundrum... if you dare!

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

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

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

Question 1

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

- a) 100% c) 85%
- b) 80% d) 70%

Question 2

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

- a) 9 c) 12
- b) 10 d) 15

Question 3

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

- a) 15A c) 25A
- b) 20A d) 30A

Answers: EBMag July 2013

Q-1: The metal assembly of a raised floor in a computer room must be bonded with a conductor no smaller than [] copper to form an effective equipotential plan.

d) #6 AWG. Ref. Rule 10-406(6).

Q-2: The CEC allows the usage of Nonmetallic Sheathed Cable in a building of combustible construction.

a) True. Ref. Rule 12-504.

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

d) All of the above. Ref. Rule 76-012, 76-016.

Effective grounding helps ensure faults are quickly removed. Rule 10-500 defines effective grounding. Sound familiar? But what's this about "impedance sufficiently low"? Appendix B provides an answer: impedance of the ground fault path should be sufficiently low so as to permit at least 5x the setting of the circuit overcurrent devices to flow during a ground fault. For example, for a 400A circuit, at least 2000 amperes (5 x 400) must be allowed to flow during a ground fault. **EB**



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