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The Ontario
ELECTRICAL CONTRACTOR **ECAO**
ELECTRICAL CONTRACTORS
ASSOCIATION OF ONTARIO

Volume 43 • Number 1 • Winter 2005



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at Annual Conference

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347 Volt Lighting Equipment

Wiring Methods
For Diesel Fuel Dispensers



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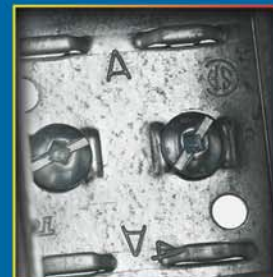
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Correction: There was an omission from the ECAO Board of Directors list in the Annual Report section of the previous issue. We would like to clarify that Dennis Tatasciore is the Director representing ECA Northern Ontario. We apologize for any misunderstanding or inconvenience this may have caused.



On The Cover: The Windsor Electrical Contractors Association Board of Directors and Conference Committee, hosts of ECAO's 2004 Industry Conference, are (from left) Franco Favaro, Ken Jacques, Sheryl Maisonville, Randy Maisonville, John Salvatore, Todd Robert, Brad Vollmer and Greg Pahomey.

Photo Credit: Dwayne St. John Photography Ltd.

The Ontario Electrical Contractor is published quarterly for:

ECAO

ELECTRICAL CONTRACTORS
ASSOCIATION OF ONTARIO

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The Ontario Electrical Contractor is the official publication of the Electrical Contractors Association of Ontario. Its purpose is to provide information and editorial comment on issues that are relevant to the electrical contracting industry.

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Published by:

MediaEDGE
PUBLISHING INC.

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Toronto, ON M2N 6P4
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CANADIAN PUBLICATION MAILING AGREEMENT #40063602

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STARTING THE NEW YEAR ON THE RIGHT TRACK

By Dave Mason

This New Year's issue of the *Ontario Electrical Contractor* magazine is filled with articles to help you start off 2005 on the right track and to remember some great times from 2004.

The ECAO wrapped up its previous year at the annual meeting and industry conference held in Windsor, September 29th through October 2nd. Be sure to check out the photo gallery both in this issue and more thoroughly on ECAO's web site. The Windsor Electrical Contractors Association hosted the 2004 conference. Their enthusiasm, hard work and southern (Ontario) hospitality made it a local conference to remember giving the delegates an entirely new appreciation of the Rose City and its attractions. The kudos I received for the conference belongs to WECA, our sponsors and the conference committee.

The annual meeting was also the time to recognize those members whose contribution has helped build the association and industry. Rick Brodhurst of Quantech Electric was honoured as the 2004 recipient of the DJB Wright Award for his years of industry leadership at the local, provincial and national levels. Safety awards were presented to Canal Marine, Comstock, Gemor Electric and S&S Bolton Electric. Congratulations to all of you.

In support of ECAO's continuing contractor education program, this issue contains the first of a number of case studies by Dr. Awad Hanna and other authorities. The first installment explores the contractual issues related to loss of productivity on an electrical/instrumentation project. Owner pre-purchasing, design changes, stacking of trades...it's all there. What went wrong? How did the contractor deal with it? What was the award?

On the technical side, the Electrical Safety Authority contributes an article on the code requirements for wiring diesel fuel dispensers in various situations. You will also notice a number of new ESA public and worker safety awareness ads/advertorials in this and future issues of the *Ontario Electrical Contractor*. ECAO is pleased to assist ESA as it moves to fulfill its expanded mandate to promote public and worker electrical safety in Ontario.

But, what better place to start 2005 than with New Year's resolutions? This month Stanley Tepner takes a completely different approach to your business financial planning needs in his article, *Financial Planning Resolutions for 2005*. This financial planning check-list is a quick and easy way to ensure you have addressed and updated your plans to accommodate changing circumstances and needs for the year to come. Personally, I like Resolution #10, which focuses on family, friends and fun. I hope, above all, that you are able to check that one off in 2005.



WIRING METHODS FOR DIESEL FUEL DISPENSERS

By Ross Sutherland

Electrical Inspectors are often asked what is the acceptable wiring method for a diesel fuel dispenser. Although diesel fuel does not constitute a hazard similar to gasoline, diesel dispensers are often installed in proximity to gasoline dispensers. This will have a direct impact on the acceptable wiring method to power up the diesel fuel pump.

A stand-alone diesel fuel dispenser may be supplied electrical power with a wiring method suitable for the environmental conditions, for example, outside, suitable for a wet location and mechanically protected as covered under Section 12 of the Ontario Electrical Safety Code.

If however, the diesel fuel dispenser is installed in proximity to a gasoline fuel dispenser or tank, the wiring method for the diesel pump is impacted by Section 20 and the wir-

Although diesel fuel does not constitute a hazard similar to gasoline, diesel dispensers are often installed in proximity to gasoline dispensers.

ing method must be suitable for either Class I Zone 1 or Class I Zone 2, depending on the distance the diesel fuel pump is separated from the gasoline dispenser.

The example in diagram 1 is typical of an installation you may find on a road maintenance work yard or a farm.

Where tech 90 cable is used in the example above, and the



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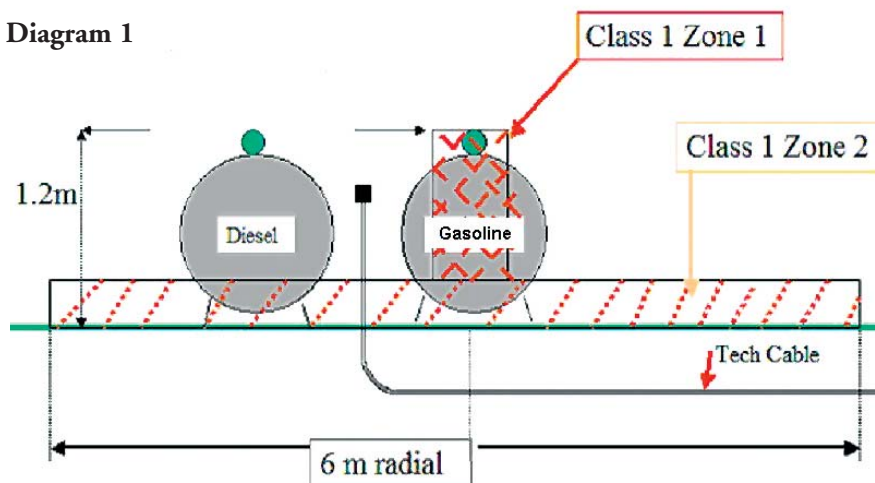
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tech cable is unbroken when it passes through the Class I Zone 2 area, no special sealing precautions are required at either end of the tech cable. The electrical supply to the gasoline pump motor would require a wiring method, which is covered by Section 18 for Class I Zone 1.

Additional precautions must be made for buildings located within the six metre radial dimension around the gasoline dispenser. If the building is not suitably cut-off by a wall or other acceptable means, the hazardous area extends into the building, as noted in Rule 20-004(6).

The use of Tech 90 for the wiring of diesel fuel dispensers, whether gasoline is involved or not, makes a quality code compliant installation. If future expansion will include a gasoline

Diagram 1



dispenser, and the Section 20 classification requirements can be met, as shown in Diagram 1, no changes to the diesel dispenser supply wiring would be required.

Additional information can be found in ESA's Bulletins. For further infor-

mation on how to subscribe to ESA's Bulletins please visit our website at www.esa-safe.com.

Ross Sutherland is a technical advisor with the Electrical Safety Authority (ESA).

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WINDSOR STRUTS ITS STUFF AT ANNUAL CONFERENCE

Delegates from across the province came to see what Windsor had in store at the 2004 ECAO Industry Conference, held September 29-October 3, at the Casino Windsor. The Windsor Electrical Contractors Association (WECA) hosted the event along with support from ECAO's industry partners. Sponsors included WECA, Federated Insurance Company of Canada, Skipwith & Associates Insurance Agency, Westburne Ruddy Electric, Tevelec and Moeller Canada.

The event kicked off Wednesday evening with an Opening Mix & Meet Wine Tasting hosted by some of southwestern Ontario's finest wine makers including Sanson Estate Winery, Colio Estate Wines, Pelee Island Winery and Erie Shore Vineyard.



Don Constans (from left), Gerry Drummond, John Raeppe, Roger Park, Cathy Park, Mike Gemmell and Ruth McMillan enjoy sampling the wine at the Opening Mix & Meet Wine Tasting hosted by Sanson Estate Winery, Colio Estate Wines, Pelee Island Winery and Erie Shore Vineyard.

work and at home, by one of Detroit's best Dale Carnegie Training® practitioners, Ralph Nichols. Following breakfast, Gerry Skipwith and Debbie DeCaire, Skipwith & Associates and Tom Hill, Hobb Bakker Bergin Hill, Chartered Accountants, presented a session on Estate and Succession Planning providing valuable insight into a business owner's financial options for managing change.

Next came the Ontario Construction Secretariat's (OCS's) presentations on Promoting Ontario's Union Construction Industry by Scott Macivor, CEO and Katherine Jacobs, manager of research and analysis. Delegates learned how the OCS has been conducting research on behalf of organized contractors, educating the public about the underground econ-

omy and enticing young people into the trades.

After lunch, delegates attended ECAO's first ever Industry Product



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Mary Raeppe (left) and Ruth McMillan enjoy a sample from the Sanson Estate Winery booth at the Opening Mix & Meet Wine Tasting.

Breakfast was served up the next morning with a motivational message on Successful Relationships, both at



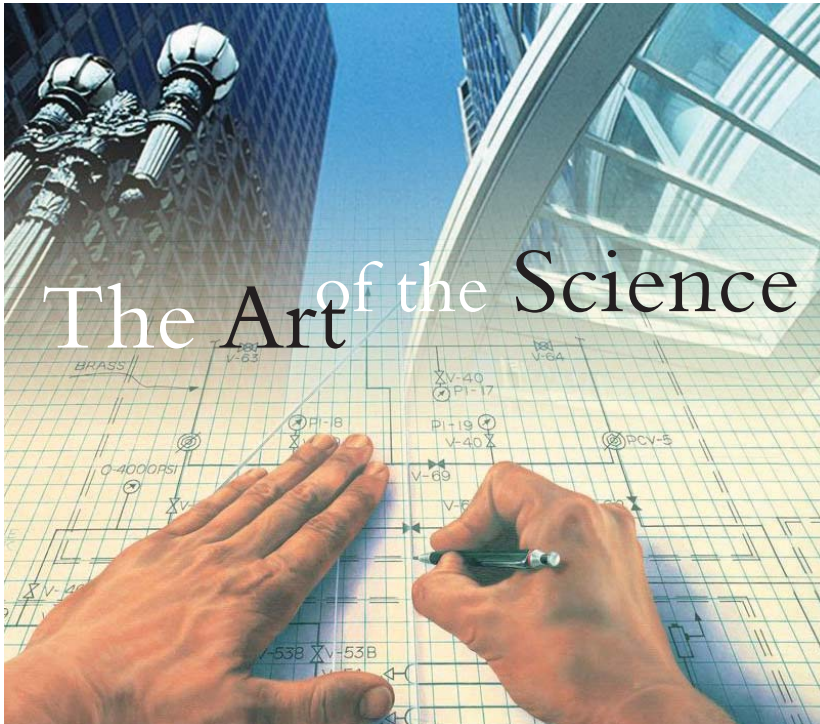
Spouses enjoy a beautiful day visiting Point Pelee National Park and Pelee Island Winery then a lake-side BBQ at the Leamington Marina provided by the Windsor Electrical Contractors Association.

feature

Exposition, an excellent one-on-one opportunity for both contractors and their industry partners. Exhibitors included electrical equipment manufacturers and suppliers, industry specific consultants such as software developers, safety organizations related to the electrical industry and service providers such as insurance brokers/agents.

Meanwhile, the spouses lucked out with the weather and went off to explore southwestern Ontario visiting Point Pelee National Park, Pelee Island Winery, Leamington Marina and the Jack Miner Bird Sanctuary.

Friday morning Tom Ouchterlony, Borden Ladner Gervais LLP, provided



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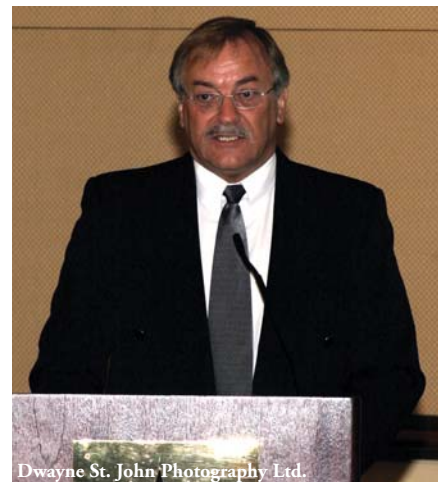
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Sheryl Maisenville
Mauro Di Tullio, Federated Insurance Co. of Canada (right) receives thanks from Conference Chair, Brad Vollmer for sponsoring the Murder Mystery Dinner at the Essex Golf & Country Club, and accepts prizes on behalf of his teammates.

his expertise on the legal duties and obligations for directors of non-share capital corporations in his session on Corporate Governance. Delegates were advised of potential sources of liability and how to minimize exposure related to their involvement with corporations, charities, etc.

Spouses stayed close to home in the morning learning about some of Windsor's finest and oldest producers of local products – Canadian Club Whiskey and Walker's Fine Candies. In the afternoon they were free to explore the Odette Sculpture Park at their leisure, a collection of pieces from 10 world-renowned artists that winds along the Detroit River waterfront.



Dwayne St. John Photography Ltd.
President Dave Mason addresses members at the ECAO Annual General Meeting.

The unseasonably warm weather held for Friday afternoon's golf game at the Essex Golf & Country Club where golfers were joined in the evening by the remaining delegates for a Murder Mystery Dinner – '70's style. The disco ball was flashing and the murderer was slashing before the



Past President George Boals presents the R. H. (Hugh) Carroll Safety Awards to Brian Rielly, Comstock Canada (left) and Gerry Snyder, Gemor Electric (right). Additional recipients not in attendance are Canal Marine and S & S Bolton Electric.

night was through.

Saturday's Annual General Meeting began with a presentation from Ted Vandevs, Electrical & Utilities Safety Association on their "Paths to Zero" safety objectives followed by the presentation of ECAO's R. H. (Hugh) Carroll Safety Awards. The Douglas J. B. Wright Award for contractor contribution and dedication for the betterment of the electrical industry was also presented at that time. Congratulations to all of the deserving recipients!

Following the AGM, delegates and spouses headed across the border to the Henry Ford Museum for an exhibition of some of America's national treasures and artifacts, including President Kennedy's fatal last ride, and the Ford Rouge Factory Tour – their recently revived attraction and



Brad Vollmer, Public Relations Committee Chair, congratulates Rick Brodburst, Quantech Electrical Contractors Limited, the 2004 recipient of the Douglas J. B. Wright Award for his dedication and commitment to the electrical contracting industry.

one of the world's largest automotive complexes.

The party lasted until the wee hours on Saturday evening as delegates and spouses attended the President's Gala Dinner and Dance, entertained by the Owen Jones Trio and Bigg Wiggle, some of Windsor's and Detroit's finest music makers.

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FINANCIAL PLANNING RESOLUTIONS FOR THE 2005 NEW YEAR

By Stanley M. Tepner

January 1, 2005. It's New Year's Day. The party last night was terrific, and you're just waking up after a long, well-deserved snooze.

Adjusting to the daylight and wiping the sleep from your eyes, you suddenly remember, "oh yeah, today's the day that I _____ (fill in the blank: go on a diet / quit smoking / start working out at the gym, etc.)"

Hardly the regimen one wants to have to face towards the end of a terrific holiday season.

Instead of jumping cold turkey, on Jan. 1, into one or more of those traditional New Year's resolutions, here is a 10-pack of really helpful financial planning resolutions that can do wonders for your cash flow, your portfolio, your tax bill, your estate plan and your overall financial well-being.

Best of all, you can wait until Jan. 2 to get started. Why mess up a great holiday on the 1st of the year?

Resolution #1

I resolve to put as much money as I can into an RRSP to maximize my RRSP contribution room. There are so many good reasons to take advantage of an RRSP, one of the few pure tax shelters remaining in Canada. The most frequently cited benefits include: significant income tax refunds, tax deferred investment growth, an easy forced savings program and, by making spousal RRSP contributions, a way to income split with your spouse during your retirement years. The main technique associated with income splitting is structuring a couple's financial affairs so that both individuals' incomes are taxed at the same marginal tax rate in the future (if possible.) Spousal RRSP contributions should be judiciously considered as a method of transferring assets from spouse to spouse for the purpose of providing the recipient spouse with a larger income base during retirement.

Resolution #2

I resolve to review all my insurance policies (life, disability, long term care, critical illness, car, auto, etc.)

Find the time to evaluate whether your existing policies truly meet your perceived needs. Do you have enough coverage, or too little? Are you getting a bang for your buck, or are you paying excessive costs? Do you even understand all your insurance policies?

Resolution #3

I resolve to review the named beneficiaries of my retirement plans, pension plan and insurance policies, and update the beneficiaries as required. Consider adding the names of secondary, or contingent, beneficiaries to the plans and policies whenever possible. One good reason: without named secondary beneficiaries on RRSPs or RRIFs, if the annuitant and the designated beneficiaries pass away coincidentally, or within 30 days of each other, the RRSP or RRIF proceeds could be subject to probate taxes if paid directly to an estate instead of to a named party.

Resolution #4

I resolve to update my will and powers of attorney. If you have amassed substantial personal assets, hire an excellent estate tax lawyer to review your will or draft up a new one, and discuss planning strategies such as setting up testamentary trusts and multiple wills. You should also update or create powers of attorney for property and health care.

Resolution #5

As a business owner, I resolve to evaluate whether I should consider setting up an Individual Pension Plan (IPP) for myself and for my senior executives. Some of the benefits of contributing to an IPP versus an RRSP are: (i) the IPP contribution limits can be substantially higher, (ii) the contributions are tax-deductible to the corporation, and (iii) assets in IPPs are creditor-proof.

Resolution #6

As a business owner, I resolve to review, update and improve existing buy/sell agreements, and business succession plans. Your business has changed, the tax laws have changed, and your needs and relationships may have changed since you last reviewed these critical elements.

Resolution #7

I resolve to perform a complete review of my investment portfolio. Are your investments in line with your short, medium and long-term goals, as well as your risk comfort level? Do you need to rebalance and/or re-jig the portfolio to a more appropriate mix? Do you understand the nature of every investment you own and the reasons for owning them? Are the investments structured in a way to minimize your annual tax costs?

Resolution #8

I resolve to develop a detailed, written personal financial plan. The old maxim goes, "those who fail to plan... plan to fail." Your detailed financial plan will evaluate all aspects of your financial life and provide the appropriate recommendations to help you achieve your short, medium and long term goals. Be prepared to do some work to assemble all the necessary information, but the results are worth the effort.

Resolution #9

I resolve to improve my financial literacy. There are more sources of financial information than ever before, with the proliferation of the Internet, new financial mag-

azines, countless books and television shows, and this ECAO magazine column. Make a commitment to regular reading, viewing and learning.

Resolution #10

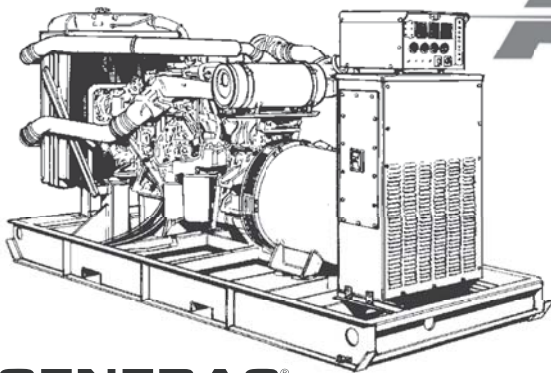
While I resolve to be more financially-focussed this year, I also resolve to continue spending quality time with my family and friends, supporting my favourite charitable causes, and having a lot of fun, throughout the year.

If you are going to commit to any of the New Year's financial planning resolutions, you are going to want to learn more about them. If you would like me to send you a special report on any one or more of the Top Ten Resolutions, then call, fax, write or e-mail me with your points of contact along with number(s) of the resolution(s) that interest you, and I'll forward the report(s) to you ASAP. Happy New Year!

Stanley M. Tepner, MBA, CA, CFP, TEP, is a First Vice-President and Investment Advisor with The Tepner Team at CIBC Wood Gundy in Toronto. He can be reached by telephone at 416-229-5566 or 1-800-488-8688 or by e-mail at Stan.Tepner@CIBC.ca. The views of Stanley Tepner do not necessarily reflect those of CIBC World Markets Inc.

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WORKING LIVE ON 347 VOLT LIGHTING EQUIPMENT

By Ted Olechna



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Electrical workplace accidents have increased 30 percent over the past six years resulting in 17 workers being killed and another 327 being seriously injured working on live electrical equipment. The Ontario Electrical Safety Code, which defines the standards for safe electrical installations, states that “no repairs or alterations shall be carried out on any live equipment” - Rule 2-304(1); and where it is not practical to disconnect an electrical system that “no one shall work on any live equipment unless protected by approved insulated or insulating devices such as tongs, rubber gloves, boots, mats, etc, which shall always be maintained in proper condition for use.” - Rule 2-306. These rules are broadly known among the electrical trades – the risk of working on live electrical systems is acknowledged – but incidents continue to occur and have been increasing.

Working on live 347-volt systems has become an area of growing concern.

Working on live 347-volt systems has become an area of growing concern. In the last four years this has resulted in three fatalities and eight severe injuries incidents involving electricians, apprentices, and maintenance personnel.

The popular 347-volt system can accommodate more light fixtures than 120-volt systems, and can be directly wired with no need for a transformer. However, connections associated with these systems require special care when servicing to keep electricians safe from electrical shock hazards. Typically, industrial and commercial lighting installations that operate at 347-volts do not have individual area switching.

A recent survey of 5,000 electricians/apprentices has told us that 80 percent of electricians place an above-average or high-risk association with working on live 347-volt systems

The lack of switching makes it difficult to de-energize the circuit when performing maintenance such as ballast changes. In addition, electricians regularly respond to customer pres-

sure to avoid work disruptions by not de-energizing circuits.

These are some of the pressures that result in a reported 71 percent of electricians working live on 347-volt systems. A recent survey of 5,000 electricians/apprentices has told us that 80

percent of electricians place an above-average or high-risk association with working on live 347-volt systems; however, 44 percent told us they believe that they can do so without sustaining injury.

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If the continuity of the shared neutral conductor is interrupted while other branch circuits are energized accidental contact with the neutral conductor will effectively connect the worker to ground thus completing the circuit and electrocuting the worker.



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risk is not the only concern associated with 347-volt. Given that 347-volt systems are multi-wire branch circuits there are other hazards to be considered – even if steps have been taken to de-energize. If the continuity of the shared neutral conductor is interrupted while other branch circuits are energized accidental contact with the neutral conductor will effectively connect the worker to ground thus completing the circuit and electrocuting the worker.

Before attempting any work on 347-volt systems make sure that the circuit is de-energized

Before attempting any work on 347-volt systems make sure that the circuit is de-energized by verifying that the circuit and its associated neutral have been de-energized by using an approved tester – don't take the risk associated with working on live electrical systems.

Ted Olechna is a Provincial Code Engineer with the Electrical Safety Authority. He can be reached by e-mail at ted.olechna@ElectricalSafety.on.ca.

CASE STUDY

Loss of productivity claims

By Dr. Awad S. Hanna

Often times a contracted project takes longer to complete and a larger budget than was originally planned. Many factors can be contributed to the increased duration and cost of a project. But who is responsible for such delays? Is it the electrical contractor, due to poor labour productivity? Or is it the owner, due to poor site management and policies? We'll look at a case study involving an electrical contractor and the engineer/owner.

Case Background

The electrical contractor had been in business out of their Ohio office since 1954. Their geographical work area includes a 50-75 mile radius from that office, which includes parts of West Virginia. The contractor became aware of a two-phase project in West Virginia, undertaken by a global industrial owner. The contractor had been contracted

by the owner before, when it was known under a different name. The contractor passed on bidding on Phase I but prepared a bid on Phase II, which consisted of electrical installation and instrumentation on additions and renovations to an industrial site.

After meeting with officials from the contractor, the owner and engineer/construction manager awarded the contractor the bid for the approximate amount of \$640,000. The contractor commenced work on Feb. 19, 1998. The bid contract indicated the project was to be completed on June 28, 1998.

Immediately after being awarded the bid, the contractor's manager was asked if he had any concerns about the project. "I have two," he said, "price and material." Regarding the price, he was told their bid was very, very competitive and close to other bids. He was also reassured that material delivery wouldn't be an issue, as the engineering firm entered a blanket order arrangement with a local electrical supplier for all owner furnished materials and all materials would be delivered to the jobsite within 24 hours of notification.



Ontario Electrical Contractor

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Owner Furnished Materials

Early on in the project, it became evident that this blanket order was simply not working. The construction manager assured the contractor that all cable tray and fitting were on the jobsite as early as Jan. 14, but three weeks after beginning the project, the contractor was still awaiting such materials. The contractor was also told all lighting fixtures would be on-site when they began the project; the fixtures arrived on-site a month later. As a result the contractor began using some material from their own inventory to keep the job moving. Representatives for the engineering firm were informed of this problem and told the contractor that the problem had been solved, but throughout the duration of the project this material shortage problem was never solved. Eventually the contractor asked the owner for permission to buy materials from other suppliers but was denied. A review of the material delivery showed that it took an average of 20 days for ordered materials to arrive on-site.

It became clear to the contractor that the engineers' original design was flawed.

Change Order Impact

It became clear to the contractor that the engineers' original design was flawed. A total of 1,000 field deviation reports throughout the duration of the project resulted in extra work orders; the electrical contractor generated 250 of these reports. The mechanical contractor for the job experienced an extreme amount of piping changes. Approximately 30 per cent of the piping system was reworked or redesigned. Since the electrical contractor follows the mechanical contractor, these changes led to the electrical contractor having to work out of sequence and leave some tasks unfinished to focus on another task.

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The high amount of change orders and the project management's poor coordination between trades led to a stacking of trades on the jobsite. Studies have consistently shown normal amount of change to be around five to 10 per cent of the original contract, yet this project underwent 36 per cent change orders. Soon more and more workers of all trades were needed. Labor density reached a peak of 104 workers in 9,600 square feet of workspace (or 92 square feet per worker). The jobsite became cluttered and disorganized. The contractor had, in their estimate, planned a peak of 20 workers; that peak turned out to be 34 workers. Scheduling, the responsibility of the engineers, was poor; delays were common. The slow material delivery times only compounded this over manning problem.

Other Impacts

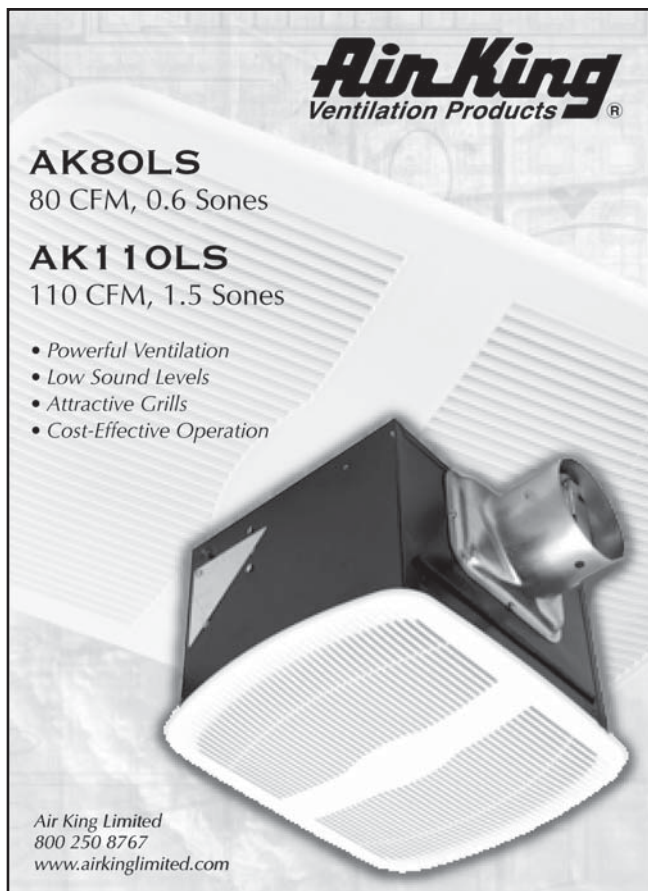
In addition, 15 separate chemical spills resulted in fume release and evacuation of the jobsite. These frequent chemical spills resulted in decreased morale and attitude of the

workers and interrupted the rhythm and flow of the project. After being informed of the problem, the owner told its contractors that the problem had been resolved and did not follow the procedure they had set in the case of fume release, making workers uneasy due to health concerns.

In the end, the poor site management was devastating to the contractor. An estimated 24-week project duration turned out to take 36 weeks.

Consequences

In the end, the poor site management was devastating to the contractor. An estimated 24-week project duration turned out to take 36 weeks. They utilized double



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the estimated man-hours, including nearly 1,500 hours of overtime. These figures were not standard for the contractor. During the same time period, using the same management staff, the same estimator, even the same workers, the contractor performed another electrical/instrumentation

In their claim the contractor blamed the owner and engineer/construction manager for the losses incurred.

job. That job was bid at 14,000 man-hours and came in at 14,500 man-hours. The contractor couldn't find any evidence that they had been accused of holding the project up; during the latter part of the job there had been no pressure by the owner to finish the job, while the pressure was immense at the beginning of the job.

As soon as the contractor realized they were going to incur increased costs due to the extended duration of the job, the owner of the contractor presented a request for an equitable contract adjustment to the owner and engineers. In the request, the forecasted damage to the contractor was \$300,000 dollars. The request was not received well; upon seeing the request the president of the owner company told the contractor's CEO, "you'll need to bring suit to get this kind of money." So the contractor did.

In their claim the contractor blamed the owner and engineer/construction manager for the losses incurred. Incomplete, vague construction plans and specifications caused some productivity losses. The fume releases contributed to a poor working environment, an environment that the owner was contractually bound to avoid. The piping redesign and rework led to delays in the contractor's work. The large amount of change orders resulted in over manning, trade stacking and a disorganized work sequence. The failure of the owner to deliver materials on time caused many unproductive hours.



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Officials from the contractor approached the defendants about reaching a settlement in the case, but none was reached. The owner claimed the contractor was to blame for the incurred losses. They said the contractor's bid was low; nearly \$350,000 lower than the next bidder. The owner said the contractor should have coordinated work between trades and taken trade orders into account on their bid and that the contract relieved them of damage liability. They said chemical fumes should be expected when working near chemical plants.

The electrical contractor used studies sponsored by the Electrical Contracting Foundation and authored by Dr. Awad S. Hanna to quantify the impact of change orders and other factors on labor productivity. Binding arbitration ruled in favor of the electrical contractor in the amount of \$351,000.

Accurate engineering is needed at the outset of a project in order to minimize change orders and keep the job running as scheduled.

Lessons Learned

Much can be taken out of this case study. The owner took a risk by agreeing to furnish all materials. In the end this is a risk not worth the overhead it may save the owner; furnishing of

materials is best left up to the contractor. The delays caused by the failure of timely material delivery cost the electrical contractor, and ultimately, the owner, much in lost productivity and damages. Accurate engineering is needed at the outset of a project in order to minimize change orders and keep the job running as scheduled. Contractors should adjust their bid to reflect risky aspects of a job. In this

The delays caused by the failure of timely material delivery cost the electrical contractor, and ultimately, the owner, much in lost productivity and damages.

case there were many risks present, such as the owner furnishing materials, the poor contract document, and working on operating units.

A major issue at the arbitration hearing was the issue of fraud. Remember the contractor's manager who was told their bid was "very, very competitive?" The owner claimed the contractor's bid was nearly \$350,000 lower than the next bidder and denied telling the contractor their bid was competitive. If the contractor had documented the minutes of their original meeting at the awarding of the bid, their claim would've been more concrete than "your word against my word."

Dr. Hanna is a professor at the University of Wisconsin-Madison, author of several productivity studies, a consultant, and an expert witness. Professor Hanna is also adjunct faculty with the Management Education Institute. He can be reached at 608-263-8903 or by e-mail at hanna@engr.wisc.edu.

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WHY AN ARC BLAST IS SERIOUS BUSINESS

An arc blast generates temperatures four times hotter than the surface of the sun. It will vaporize any material in its path.

An arc blast creates a pressure wave that can kill by percussion alone. This pressure wave can also introduce additional electrical hazards and additional impact hazards.

Hearing damage from an arc blast can be permanent.

The blast can force molten copper through the skin.

PPE FOR HIGH-RISK AREAS

Replace insertable earplugs with earmuffs. The acoustic pressure from the blast could drive an insertable earplug into the ear.

Wear flame-resistant clothing or a flash suit, even if you are not directly involved in the work. This suit greatly decreases the amount of injury you might receive.

Wear a face shield and hood with the flash suit. Safety glasses will not protect your face, though you do need to wear them with the face shield for additional projectile protection.

Do not wear synthetic clothing under the flash suit. Should that clothing catch fire from a hot object driven through the flash suit, you will not get clothing off in time to prevent serious burns or death. This applies to socks and underwear, also. Wear natural fibers only.

ARC BLAST PREVENTION

Certain situations are high risk. For example, medium voltage switchgear handles a high-energy load. Perhaps you wish to operate this switchgear to take the load offline. The proper way to do this is to shut off the smaller loads (the branches) and work your way up the “energy tree” to the MV switchgear (the trunk). When you take this approach, you greatly reduce the amount of energy jumping across the contacts or from the contacts to ground.

When connecting or disconnecting test equipment, work with one lead at a time. If you remove test leads simultaneously from energized equipment, you will very likely create an ionized path that makes a phase to ground fault almost a certainty.

Use tools insulated for the voltage levels at which the equipment is rated, regardless of whether the equipment is energized or not. If this is a new installation with no incoming power wiring, this caution doesn't apply.

If you can de-energize the equipment and ground it out, always do so.

If you must work hot, reduce the working load on the equipment as much as possible.

If you must work hot, ask operations people to suspend use of the equipment as much as possible. Your goal is to reduce the number of variables and the number of changes that could result in a fault.

Use only tools and test equipment rated for use on the equipment you are working on.

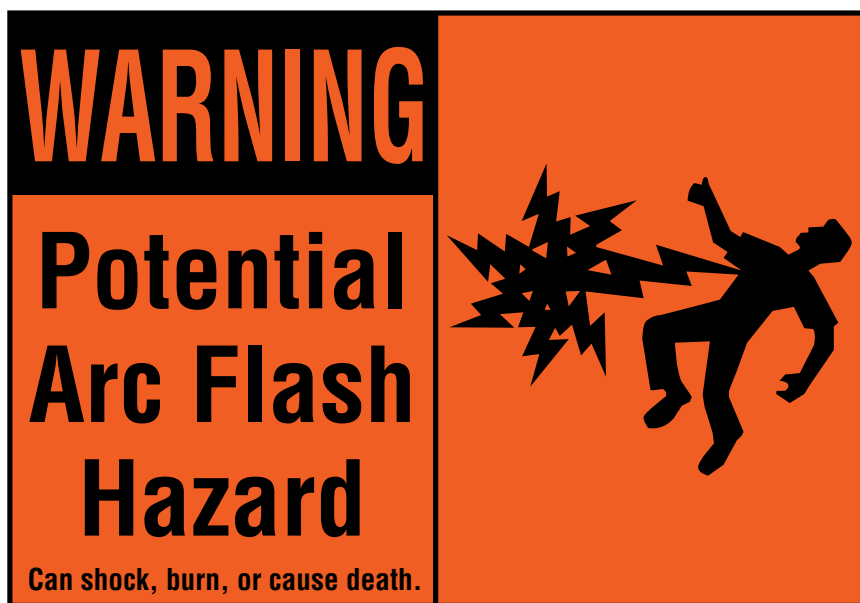
Inspect the equipment and the environment before doing the work.

PREVENTION THROUGH INSPECTION

Inspect your test leads before use. Damaged insulation can create an ionized path between the leads. When they are connected between energized equipment and ground, a ground fault will exist and that can easily create an arc blast.

Inspect the equipment before working on it. Look for signs of misuse, tampering and corrosion. Look for missing barriers at the terminals. Do a thermo-graphic scan to determine if a fault is in progress or likely to happen. If the equipment is faulty, you are at very high risk for an arc blast. Stop work and consult your foreman immediately. A process shutdown may be unavoidable, or even desirable, versus the cost of working hot on equipment that is likely to go into a catastrophic failure mode if the work continues.

Inspect the system. Drawings are often wrong, outdated or incomplete. You may think you have done a proper lock-out/tagout but if you relied purely on the drawings you may not have found all the energy sources for a given piece of equipment.



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