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BOA
Building Operators Association of Canada

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June 2021

What's Inside?

Front Cover: Centre Street Bridge Lion, courtesy of The City of Calgary: https://www.calgary.ca/csps/recreation/public-art/rotary-park-centre-street-bridge-lion.html

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City Of Calgary (All Departments)	311
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Environmental Emergency	1 800 222 6514
Poison Centre	403 670 1414
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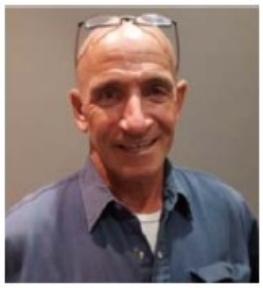
President's Message



BOA
Building Operators Association of Canada
Building Operators Association
Box 22116, Bankers Hall
Calgary, AB T2P 4J5
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I hope this message finds you and yours well and in good health

Spring is here and we have or are prepared our building for their Summer start ups. Last month we missed not having our guy Miguel Parobec of Gentech Field Services speak on Emergency generator service and maintenance. We did however have Mark Arton bring in Ainsworth to speak on what's new in large water chillers. They spoke on innovations within the industry and how that can apply to Buildings today. It was a timely seminar as we are bringing our chillers back online for the season. Some of the topics we presented to the membership are so large and complex that we never have enough time to cover all we need to know on the topics presented. An example it the one above that there is so much to learn. That you can invite the teams we present to speak to you individually or we can continue on the topics and drill down on other aspect on the subject.

Alberta Chief Power Engineers Education Committee put on a webinar last month, Approximately 60 minutes in length. Dr Mark Kolodziej gave a presentation, his topic, "**Does training automatically mean competency?"** It was an interesting event, insightful, BOA recorded it and placed it on our website under meetings. Please review it at your leisure and please make comments to me of your thoughts.

The Building Operators Association is and has always been a "not for profit association" We are made up for the most part volunteers of which I am one , but we do have monthly expenses that we have to cover. For the most part the expenses are paid by the Building Operators paying the annual dues. The $60 dollars is what we use to produce the magazine to hold meetings and maintain our association expenses. We understand times are difficult for a lot of people, however, I hope we bring value to the membership. Our treasurer, Carrissa has sent to the members an invoice for the annual dues. She usually sends out a reminder a few weeks later but the executives agree we would forgo the reminder because times are tough, I do hope that if you can afford the cost of membership that you will pay it. We have made it quite easy using PayPal is simple and convenient. We are not in dire straights yet but we do rely heavily on your dollars. Please believe me when I say we spend it thriftily and frugally. We are accountable for every dollar spent. So, if you see the invoice, please pay it. If you have misplaced it, you can go to the website, under the membership link, it can easily be renewed.

BOMA Calgary has sent the memo that there will be another class for the Building Operator 5TH class beginning again in September 2021. It is still not clear if it will again be a virtual event or if it will be held live, in the classroom. Stay tuned.

Take care of yourselves and please be kind to one another.

With kind regards,

Les Anderson PE, RPA

JOIN US! zoom

FOR OUR VIRTUAL BOA MONTHLY MEETING ON TUESDAY JUNE 8, 2021 AT 5PM

TEST YOUR OPERATOR IQ!

Are you equally adept at troubleshooting problems in the boardroom and the boiler room? As the resident facility guru, there's a lot riding on whether or not you know the difference between sounds control and a sound investment.
Try our monthly Operator IQ challenge...answers on page 15

1. **A depth type oil filter consists of:**
a) columns of compressed paper
b) pleat-folded papers
c) loosely packed fibrous material
d) absorbent substances

2. **A form of lubrication which requires continual motion of a shaft or surface is:**
a) boundary lubrication
b) alemite fitting lubrication
c) forced lubrication
d) zerk fitting lubrication
e) fluid film lubrication

3. **A is thrust bearing which does not utilize the oil wedge principle of lubrication the:**
a) Mitchell type
b) collar type
c) flotation type
d) Kingsbury type
e) vertical type

4. **A journal bearing:**
a) controls thrust movement
b) does not require lubrication
c) improves suction pressure
d) does not require a housing
e) supports a shaft

5. **A large journal bearing which is running hotter than normal can be cooled by:**
a) direct application of cool water
b) loosening the bearing caps
c) decreasing the viscosity of the oil by cooling it
d) adding pour point depressant to the oil
e) using CO_2 vapor

REVENUE METERING BASICS

BY ALBERTO QUIROZ OF INTELLIMETER CANADA

WHAT IS REVENUE METERING

Revenue metering is measuring the usage of a specific utility service like, electricity, water, gas, heat or other.

Not all the metering devices used to measure the basis of a charge for the supply of these resources can be called "revenue meter". Only approved devices that meet local regulations can be considered revenue meters.

Sub-metering or apportionment metering device used to determine costs for the supply of electricity, water, heat or gas to individual users in a multiple-unit complex is also regulated in some jurisdictions and measuring devices need approval to be considered revenue meters.

Metering devices used strictly for "non-billing" applications like energy management, or other purposes like LEED or WELL are at times called "check" meters, because their purpose will not be cost recovery and no financial transaction will take place using the readings from the device to measure in regulated jurisdictions.

WHY SHOULD I SUB-METER?

Sub-metering enables tenants and owners of buildings (central services) to calculate their own energy or water consumption and cost. Additionally multiple studies have demonstrated that buildings that are sub-metered are more efficient than those that are not.

WHY SHOULD I OWN DIGITAL METERS?

Digital meters enable:

- Interval reporting allowing for accurate demand calculations in 5, 15, 30 and 60 minute intervals to enable electricity users to manage and schedule their own consumption
- Identifying time periods during the day such as work days or weekend
- Improved accuracy for longer periods of time

WHO OWNS THIS DATA?

This is important matter to consider, some companies lease the sub-metering system retaining ownership of the metered data during the duration of the lease. In other cases the owner buys the sub-metering system, securing this way the ownership of the data, and still keeping the ability to sub-contract or assign the sub-metering and billing to a third party.

In either case, as a consumer having accessibility to the data is important. Therefore selecting a **sub-metering supplier** that can provide this access in real time is recommended.

COMPONENTS OF REVENUE METERING

Government regulations and security requirements vary in every jurisdiction and also depend on the local utilities commission if exist in general most meters must incorporate some types of se-

Continued on page 8...

curity systems.

- Traditional anti-tamper mechanical seals found on the meter
- A password-based security system for when meter values can be reset

A hardware-based security system that prevents alteration of revenue amounts after the meter is locked

HOW CAN I CONNECT A DIGITAL METER?

As long as the installation takes place "behind the meter", that is down stream from where the main utility meter is, and upstream from the first outlet of the unit to meter it should be fine, as long as the installation is performed by by a certified professional and it meets all the applicable local codes.

The primary purpose of a revenue meter is to provide the most accurate measurements for a fair financial transaction. These accuracy standards are within industry-accepted limits for accuracy within a defined range of operating conditions. Industry-accepted accuracy limits are set by International and national standards and recognized or adopted by local jurisdictions. They are meant to provide a leveled playing field to protect the consumer and to the provider.

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The Difference Between ASHRAE Level 1, 2 & 3 Energy Audits

An energy audit is the key to a systematic approach to decision-making in the area of energy management. The primary function of an energy audit is to identify all of the energy streams in a facility in order to balance total energy input with energy use. The four main objectives of an energy audit are as follows:

- To establish an energy consumption baseline;
- To quantify energy usage according to its discrete functions;
- To benchmark with similar facilities under similar weather conditions; and
- To identify existing energy cost reduction opportunities.

Before beginning an energy audit for a building or portfolio of buildings, a preliminary energy use analysis must be carried out. This analysis requires access to energy and natural gas consumption and cost data for the last 24-36 months. The purpose of this analysis is to compare the Energy Usage Index (EUI) of each building with the national average and to identify both high and low energy performers. Once the analysis is completed a recommendation is made as to which buildings should be audited first and the type of audits to be carried out.

Energy audits vary in depth, depending on the potential at a specific site for energy and cost reductions and the project parameters set by the client. As per ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) standards there are three types of audits, outlined below.

ASHRAE Level 1 – Walk-Through Analysis/ Preliminary Audit

The Level 1 audit alternatively is called a simple audit, screening audit or walk-through audit and is the most basic. It involves minimal interviews with site operating personnel, a brief review of facility utility bills and other operating data, and a walk-through of the facility, all geared toward the identification of glaring areas of energy waste or inefficiency. The data compiled is then used for the preliminary energy use analysis and a report detailing low-cost/no-cost measures and potential capital improvements for further study. Typically, a Level 1 audit will only uncover major problem areas. Corrective measures are briefly described, and quick estimates of implementation costs, potential operating cost savings, and simple payback periods are provided. This level of detail, while not sufficient for reaching a final decision on implementing proposed measures, is adequate to prioritize energy efficiency projects and to assess the need for a more detailed audit.

ASHRAE Level 2 – Energy Survey and Analysis

A Level 2 audit includes the preliminary ASHRAE Level 1 analysis, but also includes more detailed energy calculations and financial analysis of proposed energy efficiency measures. The financial analysis or Life Cycle Cost Analysis provides the facility owner with comprehensive understanding of

the financial benefits of implementing specific energy efficiency measures. Utility bills are collected for a 24 to 36 month period to allow the auditor to evaluate the facility's energy/demand rate structures and energy usage profiles. This type of audit identifies all energy conservation measures appropriate for the facility given its operating parameters. A detailed financial analysis is performed for each measure based on implementation cost estimates, site-specific operating cost savings, and the customer's investment criteria. Sufficient detail is provided to justify project implementation.

ASHRAE Level 3 – Detailed Analysis of Capital Intensive Modifications

This level of engineering analysis focuses on the potential capital-intensive projects identified in the Level 2 analysis and involves more detailed field data gathering as well as a more rigorous engineering analysis. It provides detailed project cost and savings calculations with the high level of confidence required for major capital investment decisions. This audit alternatively is called a comprehensive audit, detailed audit, or technical analysis audit. It expands on the Level 2 audit by providing a dynamic model of energy use characteristics of both the existing facility and all energy conservation measures identified. The building model is calibrated using actual utility data to provide a realistic baseline against which to compute operating savings for proposed measures. Extensive attention is given to understanding not only the operating characteristics of all energy consuming systems, but also the situations that cause load profile variations on both an annual and a daily basis. Existing utility data is supplemented with sub-metering of major energy consuming systems and monitoring of system operating characteristics.

The table below summarizes each level:

Type of Audit	Type of Audit Brief Description
Level 1	Brief on-site survey of the building Savings and cost analysis of low-cost/no-cost Energy Conservation Measure (ECMs) Identification of potential capital improvements meriting further consideration
Level 2	More detailed building survey Breakdown of energy use Savings and cost analysis of all ECMs Identification of ECMs requiring more thorough data collection and analysis (Level 3)
Level 3	Attention to capital-intensive projects identified during the Level 2 audit More detailed field analysis More rigorous engineering analysis Cost and savings calculations with a high level of accuracy

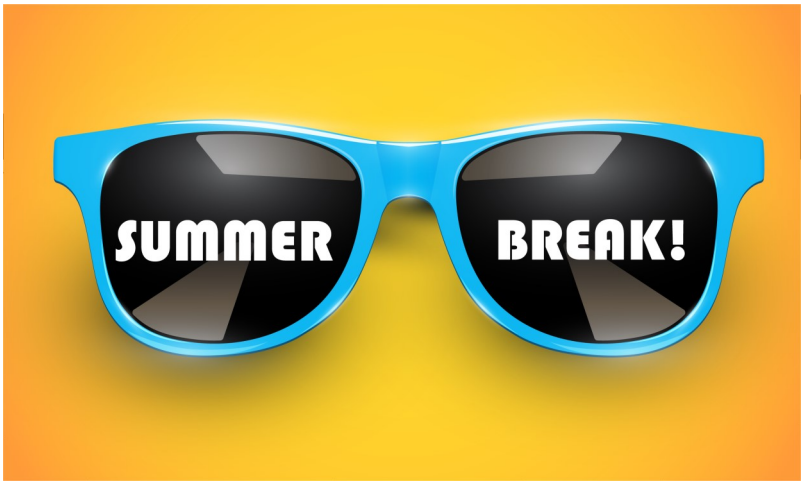
KenKen Puzzle

How to solve the Kenken puzzle:

(Answers on page 15)

- Fill in the numbers from 1 –6
- Do not repeat the number in any row or column
- The numbers in each heavily outlined set of squares, called cages, must combine (in any order) to produce the target number in the top corner using the mathematical operation indicated
- Cages with just one square should be filled in with the target number in the top corner
- A number can be repeated within a cage as long as it in the same or column

2÷		6+		5−	6×
2−	5+	11+			
		5+	10+		1
3÷	5		2÷		11+
	5−	1−		4	
5			72×		



Have a great summer!

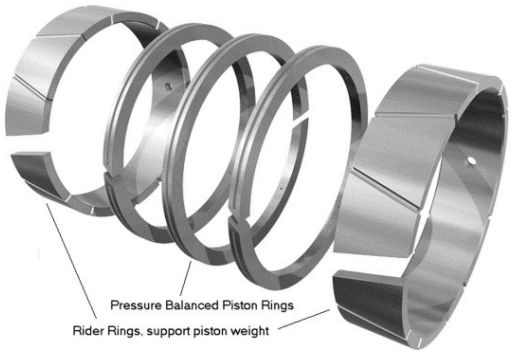
We look forward to seeing you in September!

Refrigerant and Oil Relationships Miscibility

The compressor lubricant in refrigeration and air conditioning systems has many important functions. Even though the refrigerant is the working fluid required for cooling, the lubricant or oil is needed for lubrication of the compressor's moving mechanical parts.

Oil minimizes mechanical wear by reducing friction. Oil also maintains a seal between the high and low side of the compressor. Without proper lubrication, the compressor's valves, mating scrolls, screws, and vanes would not properly seal. The results would be high-side refrigerant pressures entering the low side of the refrigeration system.

Piston rings in reciprocating compressors and rotating vanes in centrifugal compressors rely on the lubricating oil to prevent blow-by around the pistons and vanes. Oil also acts as a noise dampener within the compressor and transfers heat away from moving and rotating parts within the compressor.

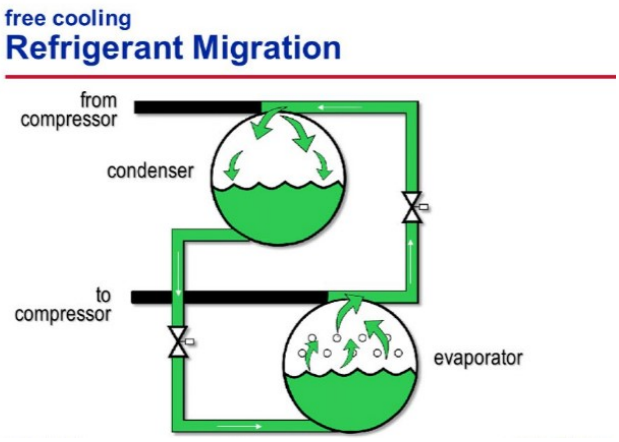


Under normal conditions, there will always be a small amount of oil that escapes a compressor's crankcase and is circulated with the refrigerant throughout the system. It is for this reason that refrigerant oil and the refrigerant itself must be soluble in one another. It is the velocity of the circulated refrigerant that carries the oil back to the compressor's crankcase. If the two were not soluble in one another, this phenomenon could not happen. This is why line, coil, and valve sizing is critical to maintaining the refrigerant velocity required for proper oil return.

REFRIGERANT MIGRATION

During a compressor's off cycle, and especially during a long shutdown, refrigerant will travel to a place where pressure is the lowest. Refrigerant migration is defined as refrigerant, either liquid or vapor, traveling to the compressor's suction line or crankcase during the off cycle.

In nature, fluids travel from a place of higher pressure to a place of lower pressure. The crankcase usually has a lower pressure than the evaporator because of the oil it contains. Refrigeration oil has a very low vapor pressure and refrigerant will flow to it whether the refrigerant is in the vapor or liquid state. In fact, refrigerant oil has such a low vapor pressure it will not vaporize even when a 100-micron vacuum is pulled on the refrigeration system. Some refrigeration oils have a vapor pressure as low as 5-10 microns. If the oil did not have a very low vapor pressure, it would vaporize every time a low pressure existed in the crankcase or when a



vacuum was pulled on the crankcase.

Because refrigeration migration can occur with refrigerant vapor, the migration can occur uphill or downhill. When the refrigerant vapor reaches the crankcase, it will be absorbed and condense in the oil. Once this phenomenon happens, the liquid re-

frigerant will be on the bottom of the oil in the crankcase because it is heavier than the oil. Often, manufacturers will incorporate a crankcase heater on the compressor.

Crankcase heaters are designed to help keep the oil in the compressor's crankcase at a temperature higher than the coldest part of the refrigeration system. If refrigerant migration occurs as a vapor and the system has a crankcase heater, the vapor will be forced away from the crankcase and be driven back into the suction line. This refrigerant may condense in the suction line and cause slugging in the compressor's cylinders on the next start-up. Crankcase heaters do combat refrigerant migration to the compressor's crankcase oil. They also prevent oil and refrigerant dilution within the compressor's crankcase. However, they do not prevent refrigerant slugging at start-up.

SLUGGING

With reciprocating compressors, slugging is liquid refrigerant or liquid oil actually trying to be compressed in the cylinders of the compressor. Slugging happens during the compressor's on cycle. As we know, liquids cannot be compressed and attempts to do so generate tremendous reversal forces that often result in broken parts. Slugging can especially happen if the compressor is located outdoors in a cold ambient. The cold ambient will amplify the lower vapor pressure area and help condensed the refrigerant vapor to liquid. As mentioned earlier, a crankcase heater helps keep the oil in the crankcase free of refrigerant caused from refrigerant migration.

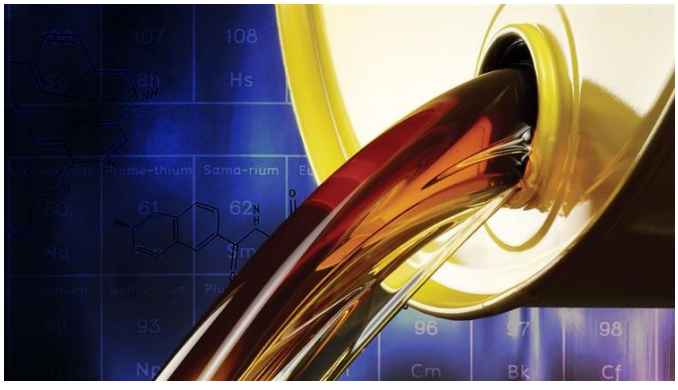
On short compressor off cycles, the migrated refrigerant does not have a chance to settle under the oil but still mixes with the oil in the crankcase. When the compressor turns on, the sudden pressure drop in the crankcase containing liquid refrigerant and oil will cause the refrigerant in the oil to rapidly flash to a vapor. This causes violent foaming in the crankcase. The oil level in the crankcase will then drop and mechanical parts will be scored from inadequate lubrication. The crankcase pressure will rise, and the mixture of refrigerant and oil foam can now be forced through compressor passages, around piston rings, and pumped by the compressor into the refrigeration system.

Not only does this situation cause loss of oil from the crankcase, it also can cause a mild form of slugging in the compressor's cylinders. High compressor current draw, which will lead to motor overheating, usually follows. Also, broken or warped valves can occur as a result of overheating and/or slugging.

AUTOMATIC PUMP DOWN

The only sure remedy or solution to avoiding refrigerant migration is to get rid of all refrigerant in the evaporator, suction line, and crankcase before every off cycle. This can be accomplished via an automatic pump down system. A thermostat controlling box temperature is wired in series with a liquid line solenoid. When the box temperature is satisfied, the thermostat contacts open. This de-energizes the liquid line solenoid and initiates a pump down cycle. All the liquid and vapor refrigerant from the solenoid forward through the compressor will soon be pumped into the high side (condenser and receiver) of the system. Once the low-side pressure reaches about 69 KPa, a low-pressure controller will interrupt the compressor circuit and initiate an off cycle. The system is now pumped down, and migration cannot occur because of lack of refrigerant vapor and liquid in the evaporator, suction line, and crankcase. Figure 1 illustrates an electrical and mechanical hookup of an automatic pump down system.

When the box thermostat calls for cooling, the liquid line solenoid is energized, and refrigerant pressure will travel through the metering device to the low



side of the system. This pressure will cause the cut-in pressure of the low-pressure control to close its contacts and bring the compressor to another on cycle. The cut-in pressure for the low-pressure control is

system- and refrigerant-dependent. It has to be high enough to prevent any short-cycling of the compressor during an off cycle but low enough to allow the low-side pressure to reach it when an on cycle is initiated by the box thermostat. Actual trial and error will allow a service technician to determine the low-pressure control's settings.

Most every low-pressure controller (LPC) has an adjustment to set the cut-in and cut-out pressure to cycle the compressor. There may also be a differential control on this same controller. The difference between the cut-in and cut-out pressures of the LPC is referred to as the differential. For example, if a system is set to cut-in at 172 KPa and has a 103 KPa differential, the cut-out pressure would be 69 KPa. Refer to the equation below:

172 KPa cut-in pressure
- 103 KPa differential
= 69 KPa cut-out pressure

It's important not to let the low-side pressure get too low before shutting off the compressor. If the low-side pressure was allowed to drop to 0 KPa before the low-pressure control terminated the cycle every off cycle, damage could occur to the compressor from lack of refrigerant mass-flow rate and high compression ratios. This severely unloads the compressor and may cause overheating from loss of the cooling effect on the compressor's windings. A cut-out pressure of 69 KPa is low enough to ensure most of the liquid and vapor refrigerant has been cleared from the evaporator, suction line, and crankcase to prevent refrigerant migration during the off cycle.

Many times, systems will use an electronic expansion valve (EEV) in place of the liquid line solenoid. An algorithm in the valve's software will throttle the EEV closed when it is time for an automatic pump down to occur and open it when it is time for the next on cycle.

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Just for laughs! LOL!

"Have you heard of Murphy's law?"

"Yeah."

"What is it?"

"If something can go wrong, it will go wrong."

"That's right. Have you heard of Cole's law?"

"No, what is it?"

"Thinly sliced cabbage and mayo."

BOA

Building Operators Association of Canada

Tradeshow

POSTPONED

UNTIL

May 2022

Kenken Puzzle Answer

2÷ 2	4	6+ 5	1	5− 6	6× 3
2− 4	5+ 3	11+ 6	5	1	2
6	2	5+ 4	10+ 3	5	1 1
3÷ 3	5 5	1	2÷ 4	2	11+ 6
1	5− 6	1− 3	2	4 4	5
5 5	1	2	72× 6	3	4

TEST YOUR OPERATOR IQ ANSWERS

Answers: 1) b 2) e 3) e 4) e 5) b

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WHAT ARE ZEVS?

By Alberto Quiroz

Historically, transportability and fossil fuels have been intrinsically linked; Since the invention of the ICE (Internal Combustion Engine) the extent of its applications, from agricultural to industrial and then to the growth of cars, trucks, ships, and trains is closely correlated to the consumption of fossil fuels and climate change. Today, **transportation produces 28% of all greenhouse gas emissions** in North America.

While electric vehicles have been successful only in few niche markets many factors are accelerating the adoption of electric transportation for the mass market, key drivers fueling this acceptance are:
Generation awareness of **Climate Change**
Advances in **Renewable Energy**

- Electric Battery Technology
- Big Data Analytics
- Electric Motor Technology
- Lower **Cost of semiconductors and electronic components**
- Affordability of ZEVs

WHAT ARE ZEVS?

Zero-Emission Vehicles (ZEVs) are vehicles that DO NOT emit any harmful pollutants, like **Green House Gases**, particulates, carbon monoxide, lead, or other toxic pollutants; under any possible operational modes and conditions. Today ZEVs are less expensive to fuel than vehicles powered by gasoline or diesel. In addition to **lower cost of ownership** electric motors offer fewer moving parts than conventional Internal Combustion Engines (ICE), For instance; a Tesla drive-train has only 17 moving parts while a single ICE close to 200 moving parts.
Under the ZEV regulation, there are three types of zero-emission vehicles:

1. **BEVs: Battery Electric Vehicles**, which run exclusively on rechargeable batteries;
2. **FCEVs: Hydrogen Fuel Cell Electric Vehicles** are powered by Hydrogen that when passed through a fuel cell produces electricity to run electric motors.

ZERO-EMISSION VEHICLES ARE THE FUTURE

Gasoline and diesel engines are primarily responsible for the large percent of nitrogen oxide and crude matter emissions in North America. Zero-Emission Vehicles on the other hand are an essential part of the climate mitigation and adaptation strategy of many countries around the world.

More countries and states have enacted legislation and executive orders to address climate change and adopting ZEVs in future.

To illustrate one; The ZEV standard came into effect on January 11, 2018. Quebec, British Columbia, **California**, Connecticut, Maine, Maryland, Massachusetts, New York, New Jersey, Oregon, Rhode Island, and Vermont have adopted ZEV standards for passenger vehicles; a trend likely to continue as younger generations will be more proactive in protecting the planet.

TAKE AWAY

The number and type of ZEVs will continue to grow as automakers develop a portfolio of ZEV technologies either to compete with many new ZEV startups or to respond to future regulations. An access to charging or fueling infrastructure will soon need to be addressed as the adoption of ZEVs increase in high numbers.

When it comes to ZEV passenger vehicles and existing building infrastructure, the need to maximize the distribution of the available capacity for charging and installing **Energy Management Systems** for EVs will be high on property managers mind.

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May Meeting Minutes

Chaired by:	Minutes by:	Call to order:	Webinar: May 11, 2021
Mark Arton	Monika Bhandari	5:01pm	

- **Introduction from Mark Arton**

Guest Speakers:
Rick Hack, Sheldon Tetrault And Paxton Lang with Norm Denslow Ainsworth Inc.

Topic: **Water Colled Chillers—What's New?**

New Business:

- Will send gentle reminders for payment of membership dues; please support us!
- BOA Tradeshow postponed until May 2022
- More webinars to be presented possibly a few a month—share your ideas with BOA Executive
- Visit the website for YouTube videos of last meetings; download BOA Magazine from www.boacalgary.com
- Next virtual (zoom) meeting on June 8 2021, 5PM
- Current balance is $5883.78

JOIN US: TUESDAY JUNE 8, 2021 AT 5PM FOR OUR VIRTUAL MONTHLY MEETING

Guest Speaker: **Luc Chamberland, Sales Manager Canada—Control Valve Specialist, Spartan Peripheral Devices**

Title & Brief: **HVAC Control Valves - What You Need to Know**

Luc joined Spartan Peripheral Devices in 2010. He has been working in the industrial Instrumentation automation field since 2000 in various sales departments positions from OEM Specialist to commercial channel sales market.

Over the years, Luc's reputation as control valve retrofit specialist has been spreading in Canada's major engineering firms. He has become a reference for mechanical departments coast to coast.
As an active ASHRAE Montreal chapter member, he has been representing Spartan Peripheral Devices since 2010 in HVAC exhibitions CMPX - CMX - CIPHEX WEST AB,BC MEET Trade Shows.

Luc gained a lot of experience in the HVAC commercial market working on various large scale projects. Performing a variety of tasks such as presentations to Engineering Firms providing Technical Support Control Valves ID-Flow sizing CV-Control Valve Retrofit Solution Specialist

Supporting projects through engineering design, integration, commissioning and start-up activities and working with customers' engineers to define functional requirements while managing customer expectations are some of the Luc's key responsibilities. Luc is focussed on problem solving and helping understanding control valves and the applications they are involved with in our daily lives.

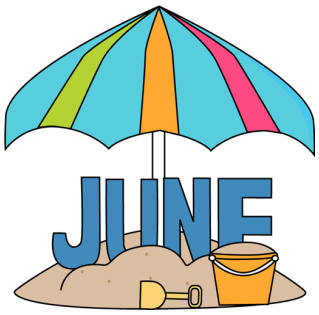
Click on the link to register for the BOA Monthly Meeting

zoom

BOA Building Operators Association of Canada

May 2021 General Meeting Attendance

Les	Anderson	George	Niksic	San	Ban
Sheldon	Tetrault	Godfery	Licayan	Seyed	Hosseini
Mark	Arton	Alevis	Rodriguez	Scott	Brooks
Rick	Hack	Matthew	Adams	Dean	Siemens
Norm	Denslow	Casey	Kok	Shawna	Longeuay
Ed	Smid	Fred	Costoy	Don	Schaab
Rex	Matibag	Cory	McWhinney	Jose	Hernandez
Kyle	D'Agostino	Gary	Gottwald	Frank	Giugovaz
Josh	Hogan	Monika	Bhandari	Blair	Bohnet



BOA CALGARY OPERATOR MAGAZINE ADVERTISING RATES:

1/8 page	$200	**Premium Locations:**	
1/4 page	$400	1/2 page inside/outside cover	$850
1/2 page	$775	1/2 page outside cover	$900
Full page	$1000		

Deadline for ads is the 10th of each month. For any questions, please email: advertising@boacalgary.com.

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Black & McDonald	403-235-0331
Boulder Mechanical Contractors Ltd.	403-230-5519
Indoor Air Quality Services	403-276-2201
Gasonic Instrument Inc,	
Black & McDonald	403-235-0331
Lighting Services	
Calgary Lighting Products	403-258-2988
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