



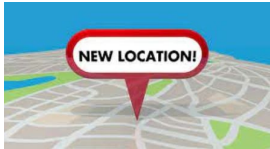
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Official Publication of the Building Operators Association (Calgary)

April 2026



Thornccliffe Greenview Community Association

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Important Phone Numbers

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Alberta Labour (Emergency)	403 297 2222
Buried Utility Locations	1 800 242 3447
City Of Calgary (All Departments)	311
Dangerous Goods Incidents	1 800 272 9600
Environmental Emergency	1 800 222 6514
Poison Centre	403 670 1414
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President's Message

I hope this message finds you & yours well and in good health

The role of senior operations staff in protecting junior operators is to maintain a safe, efficient, and compliant building environment by ensuring that experienced Building Operations Personnel provide consistent, hands-on training in safe work practices. This responsibility includes guiding junior and newly hired operators through every task they will be expected to perform.

BOA has already identified 180 tasks that Building Operators typically complete each year, available in the Articles section of our website. Each of these tasks should be audited and ranked from most hazardous to least hazardous.

A competent senior staff member must walk junior workers through each assigned task, explaining the purpose of the task, the associated hazards, and the required controls. Trainers must demonstrate proper procedures when working with building systems such as HVAC equipment, electrical panels, boilers, pumps, fire-life-safety systems, and building automation systems.

Every task should undergo a hazard-level audit, and a corresponding Safe Work Procedure must be written to outline how to complete the task safely from start to finish. All work must be



performed using approved tools, PPE, and lockout/tagout procedures.

Hands-on instruction is essential. New workers—or workers who have performed a task before but require refresher training—should observe the task being performed, then demonstrate it back to management. Competency must be verified and formally signed off.

For complex or inherently hazardous tasks, hazard awareness must be reinforced regularly. These tasks should have scheduled review dates, with sign-off by designated personnel to ensure ongoing competency and safety compliance.

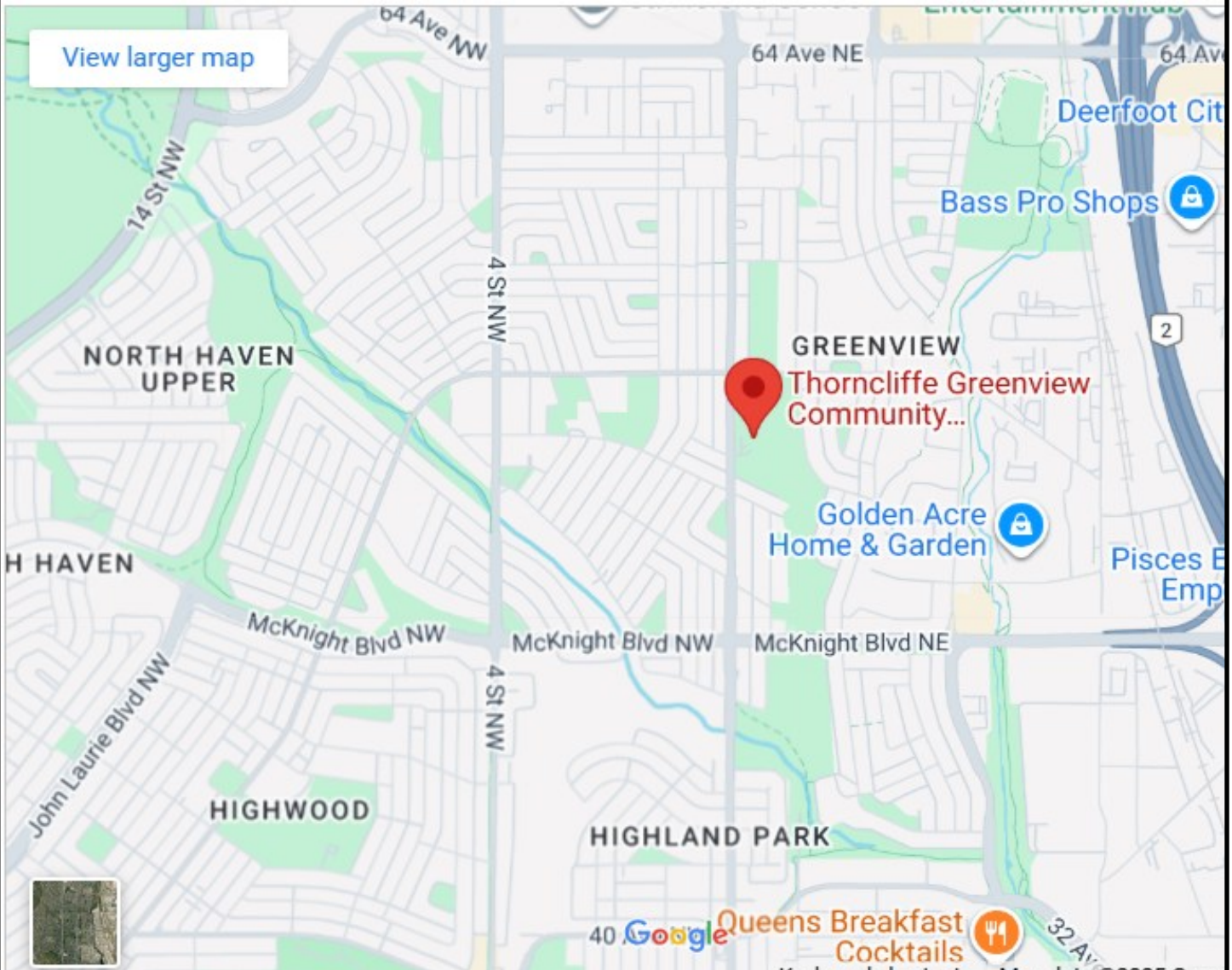
The monthly meeting with a guest speaker and times will remain the same: **second Tuesday of each month. Meetings from 5-7 PM at the Thorncliffe Greenview Community Association 5600 Centre Street North**, there is plenty of parking available. **We look forward to seeing you there!**

Smiles))

Les Anderson
BOA Calgary President



**Join us at our Monthly Meeting on
Tuesday April 14, 2026
at our new location:
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5600 Centre St N, Calgary, AB T2K 0T3**



**Meeting starts at 5pm to 7pm
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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 sound control and a sound investment.

Try our monthly Operator IQ challenge...answers on page 32

- 1. The emergency discharge line in a refrigeration system:**
 - a. is located only on the condenser
 - b. should have a shut-off valve outside the building
 - c. is required on all sizes of refrigerating units
 - d. is located on the evaporator
 - e. is a vented sewer line

- 2. Select the correct statement from the following concerning pressure gages used in refrigeration:**
 - a. they indicate pressures and the corresponding temperatures in a system
 - b. dials on refrigeration pressure gages do not indicate saturation temperature
 - c. only one pressure gage is required for each system
 - d. the pressure gage will not work if the system is equipped with pulsation dampeners
 - e. None of the above

- 3. The accessory which maintains efficient heat transfer by collecting oil that coats the tubes of the condenser is called a/an:**
 - a. strainer
 - b. strainer-drier
 - c. oil scrubber
 - d. filter
 - e. oil separator

- 4. The function of vibration absorbers is to:**
 - a. lower noise levels
 - b. reduce pipe hammer
 - c. increase longevity of the system
 - d. insulate piping and make the system more efficient
 - e. allow the load on the system to increase dramatically without straining the components in the system

- 5. The purpose of the chemical dot found under the glass lens, and which is exposed to the liquid refrigerant is to monitor the:**
 - a. liquid flow
 - b. refrigerant levels
 - c. the presence of moisture
 - d. the presence of foreign particles
 - e. the pressure levels

A Brew with the Boss: When Did You Last Sit Down with Your Team Without an Agenda?

Juan Carlos LaGuardia Merchán



In the relentless, often unseen world of **Facility Management** and **Building Operations**, our days are dictated by checklists, SLAs, budgets, and the inevitable, hair-raising emergency call. We are the orchestrators of the physical environment the invisible infrastructure that keeps the business thriving. From managing complex HVAC systems to negotiating supplier contracts, it's a non-stop, high-stakes game.

Amidst this operational intensity, it's easy to slip into a purely transactional leadership style. We become commanders of tasks, signers of POs, and arbiters of disputes. But here's a quietly profound question: when did you last sit down with a member of your frontline team a maintenance technician, a cleaning supervisor, a helpdesk operator without a single item on the agenda? Just a

simple cup of tea, or perhaps a strong coffee, and an open ear?

Beyond the KPI Dashboard: The Human Element

I've spent years navigating the labyrinthine corridors of large commercial properties, and if there's one thing I've learned, it's that the most sophisticated **Building Management System (BMS)** is ultimately controlled by human hands, human judgement, and human commitment.

We talk a great deal about **Operational Resilience** and **Asset Lifecycle Management**, yet we often neglect **Human Resilience**.

A true leader, particularly in a high-pressure environment like ours, understands that their team is not merely a resource, they are the *eyes and ears* of the operation. They spot the subtle vibration in a pump that signals an impending catastrophic

failure; they notice the creeping damp that a scheduled inspection might miss; they are the first to hear the quiet grumbles of an unhappy occupier. That invaluable, tacit knowledge is only unlocked through genuine connection.

Think of it like the difference between a simple software update and a complex system migration. The former is routine; the latter requires intricate planning and trust. Likewise, a scheduled performance review is a necessary *transaction*, but a spontaneous, agenda-less chat is an **investment**.

The Art of the Unscheduled Check-In

I remember a time when a major power outage threatened to shut down an entire data centre. The panic was palpable. After the crisis was averted—thanks to the quick thinking of my shift engineer, Dave, I didn't just send an email of commendation.

The next morning, I walked onto the floor, offered him a chocolate digestive and a brew, and simply asked: "How are you *really* doing after that? That must have taken a toll."

The shift in his posture was immediate. He relaxed, he shared the sheer weight of responsibility he felt, and then, he dropped a critical piece of operational intelligence: an ongoing issue with a specific transfer switch that he had been reluctant to formally log because he thought it might sound like he was complaining. Because I had created a safe space *outside* the rigid reporting structure, I gained insight that helped us prevent a future, far more costly incident.

This isn't about being a *mate*; it's about being a *mentor* and a *champion*. It's about demonstrating that you see the person behind the hi-vis jacket and the daily work order.

Sitting Alongside, Even When the News is Bad

The real test of leadership, however, comes not in the glory of a successful project handover, but in the trenches when a key service delivery partner fails, a budget is slashed, or a major piece of plant breaks down prematurely.

It's tempting, as a senior manager, to isolate yourself and deal with the external pressure. Yet, this is precisely when your team needs your presence the most.

A good leader listens, offers a steady hand, and sits *alongside* you, even when the work hasn't gone well. They don't immediately jump to assigning blame or demanding an instant, perfect solution. Instead, they frame the setback as a shared learning opportunity. "Right," you say, "this didn't land as we hoped. Let's trace it back. What did we learn here that will make us sharper for the next challenge?"

This vulnerability, this willingness to step into the mess with them, builds the kind of deep loyalty and proactive problem-solving attitude that no KPI can measure. It transforms a team of individuals into a cohesive unit of resilient problem solvers. It fosters an environment where people feel safe enough to admit mistakes quickly, which, as any seasoned FM knows, is the single most important factor in mitigating risk.

So, next week, try this simple experiment. Skip one of your internal status meetings. Instead, grab that cup of tea. Walk down to the boiler room or stop by the helpdesk. Pull up a chair. Don't look at your watch. Just ask an open question and genuinely listen. You'll be astonished by the operational intelligence and human connection you receive in return. That connection, that *presence*, is the true foundation of exceptional Facility Management.

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Clear the Way for Safety!



Blocked exhaust vents can cause deadly carbon monoxide (CO) to build up inside your home. After every snowfall, check and clear vents for furnaces, fireplaces, and water heaters. Stay safe this winter!



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Chiller Approach And Condenser Approach in HVAC System

Chiller Approach is a very important parameter in an HVAC system. It is used to measure the performance of the chiller and its heat transfer efficiency.

Normal Value

Air Cooled Chiller: 5°F to 10°F ($\approx 2.7^{\circ}\text{C}$ to 5.5°C)

Water Cooled Chiller: 3°F to 7°F ($\approx 1.7^{\circ}\text{C}$ to 3.9°C)

Importance

1. Efficiency Check – If the approach is high, it means heat transfer is not happening properly.
2. Fouling Indication – High approach indicates evaporator tubes may be dirty or scaled.
3. Maintenance Indicator – Shows whether the chiller needs cleaning or servicing.
4. Performance Monitoring – Regular checking of approach gives an idea of chiller health.

Causes of High Approach

Scaling / Fouling / Oil film in the evaporator.
Low refrigerant charge (gas shortage).
Poor water quality.
Refrigerant flow restriction.
Heat exchanger design problem or defect.

Condenser Approach

Why is Condenser Approach measured?

1. It indicates heat transfer efficiency.
2. To assess the performance of the condenser in a chiller.
3. If the approach is high, it means the condenser is not rejecting heat properly.
4. It is very important for preventive maintenance and energy saving.

Normal Value of Condenser Approach

Normally considered 0.5°C to 1.5°C (under design conditions).

If it goes above 2°C , there may be some issue with the condenser.

Causes of High Condenser Approach

If condenser approach is higher than 2°C , possible reasons are:

1. Fouling/Scaling – Dirt or scale deposition on condenser tubes.
2. Insufficient Water Flow – Inadequate flow from cooling tower or pump.
3. High Condenser Load – Excessive heat rejection.
4. Air Pockets – Air trapped inside the condenser.
5. Tube Corrosion/Damage – Poor condition of condenser tubes .

Low Condenser Approach

If the approach is very low (below 0.5°C), it is also an abnormal condition. This may be due to sensor calibration error or measuring mistake.

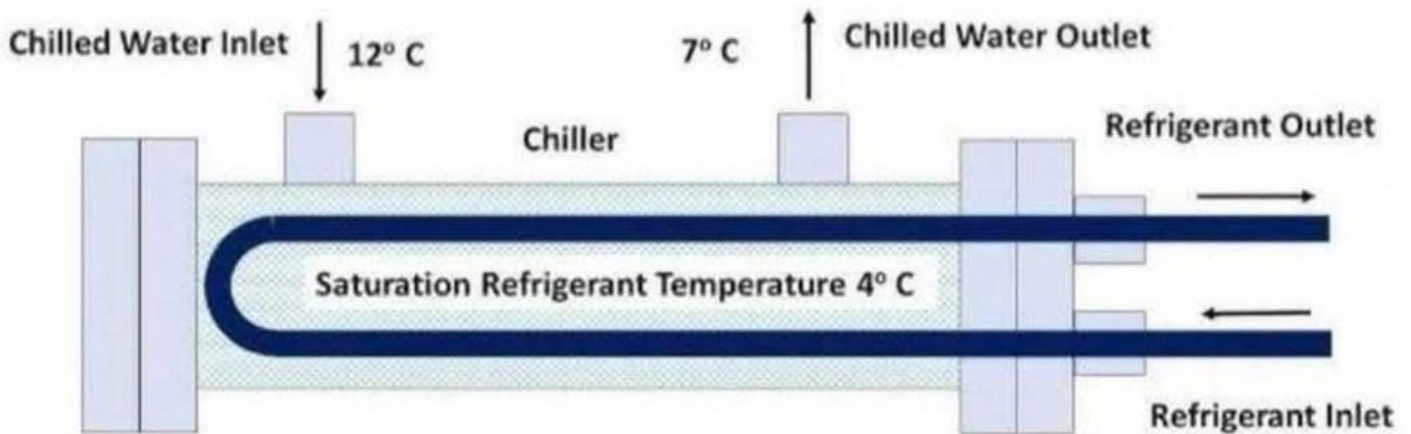
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Chiller Approach

Chiller approach = Chilled water Outlet temperature – Saturation refrigerant temperature

$$\text{Chiller approach} = 7^{\circ}\text{C} - 4^{\circ}\text{C}$$

$$\text{Chiller approach} = 3^{\circ}\text{C}$$

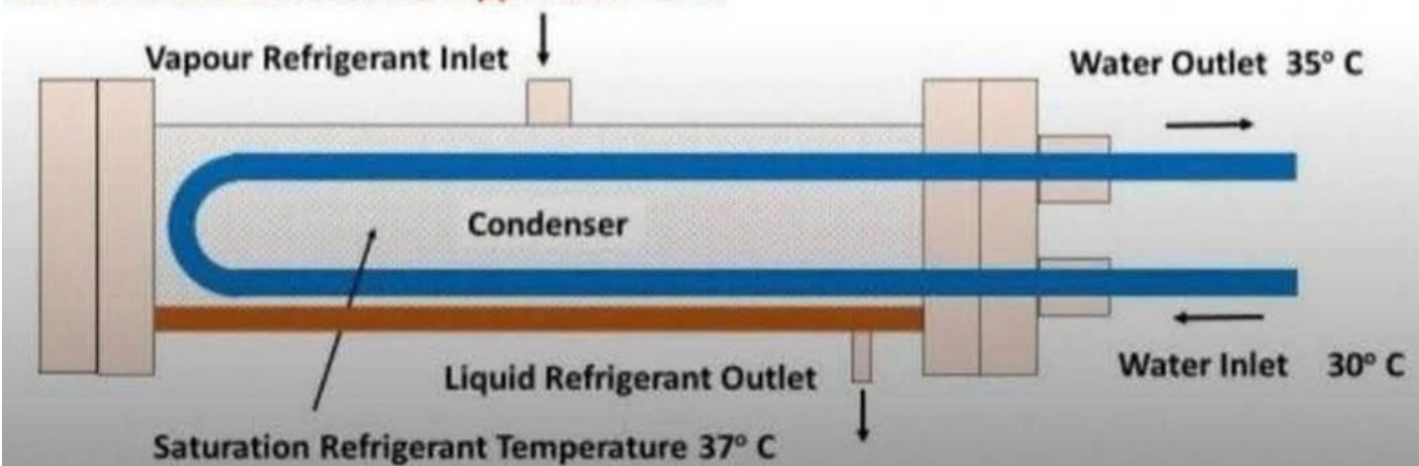


Condenser Approach

W/C Condenser Approach = Sat. Refrigerant Temp. – Leaving Condenser Water Temp.

$$\text{Water Cooled Condenser Approach} = 37^{\circ}\text{C} - 35^{\circ}\text{C}$$

$$\text{Water Cooled Condenser Approach} = 2^{\circ}\text{C}$$



IMPORT UPDATE: LOCKBOX PROGRAM



Honeywell has discontinued the TRACcess (Supra) lockbox product line along with all support and services. Because this change comes directly from the manufacturer, any Supra lockbox lids currently installed on business premises will need to be replaced or retrofitted to remain compliant with the National Fire Code.

To maintain secure emergency access and code compliance, all existing Supra lockbox lids must be retrofitted with the approved Knox Lift-Off Retro Lid before **December 31, 2026**. Orders should be placed through the Knox website before **October 30, 2026**, and installations must be completed by CFD. Non-compliance fees will apply after the deadline.

We've also implemented several cost-saving measures for businesses, including removing third-party lockbox inspection requirements, waiving key-add fees during retrofit, and eliminating the need for locksmith/provider contracts.

If you're able to distribute the notice below to your members, it would be extremely helpful in ensuring building operators are aware of these requirements and timelines.

If anyone has questions or needs clarification, they can visit calgary.ca/lockboxes or contact lockbox@calgary.ca.

Best regards,

Michael Garner

Fire Inspections Coordinator

Calgary Fire Department



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Daisy



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Power Quality Analysis

1. Enhanced Equipment Reliability and Lifespan

Power disturbances such as voltage sags, swells, transients, and harmonic distortion can significantly affect the performance and lifespan of electrical and electronic equipment. Sensitive devices like Variable Frequency Drives (VFDs), Programmable Logic Controllers (PLCs), servers, and automation systems are especially vulnerable.

Benefit:

- Reduces unexpected breakdowns.

- Extends the service life of expensive machinery and electronics.
Minimizes replacement and repair costs.

2. Improved Energy Efficiency

Unstable power quality leads to increased reactive power, excessive heat, and losses in motors, transformers, and cables. Harmonics can cause additional heating, derating of transformers, and inefficient energy use.

Benefit:

- Identifies opportunities for power factor correction and harmonic mitigation.



- Decreases energy waste and lowers utility bills.
- Supports green energy initiatives and corporate sustainability goals.

3. Minimized Downtime and Operational Interruptions

Production facilities and data centers rely on uninterrupted power. Power quality disturbances can trigger safety devices, halt processes, or cause data loss.

Benefit:

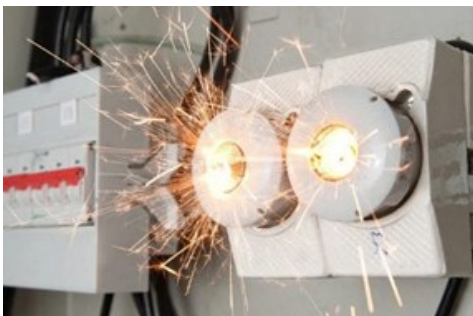
- Helps maintain operational continuity.
- Prevents revenue loss due to production stoppages.
- Protects critical infrastructure in 24/7 operations like hospitals, server rooms, and process industries.

4. Reduced Maintenance and Operating Costs

Poor power quality leads to frequent equipment failures and premature wear-and-tear on electrical components such as contactors, capacitors, fuses, and circuit breakers.

Benefit:

- Diagnoses the root cause of recurring electrical issues.
- Enables preventive rather than reactive maintenance.
- Reduces the frequency and cost of service calls and parts replacement.



5. Compliance with Regulatory and Utility Standards

Many utilities impose penalties for poor power factor or excessive harmonic distortion. Standards like IEEE 519 and IEC 61000 set benchmarks for acceptable power quality.

Benefit:

- Ensures compliance with utility agreements and national/international standards.
- Avoids financial penalties and disconnection risks.
- Prepares facilities for audits, ISO certification, and energy efficiency programs.

6. Data-Driven System Optimization

Power quality analysis provides detailed insight into voltage, current, frequency, power factor, THD (Total Harmonic Distortion), load imbalance, and transient behavior.

Benefit:

- Enables intelligent system upgrades (e.g., installing harmonic filters, surge protection, UPS systems).
- Optimizes the sizing and selection of transformers, conductors, and power conditioning devices.
- Supports capacity planning for future load growth or renewable integration.

7. Enhanced Safety

Power disturbances can cause overheating, arcing, insulation failure, and even fire hazards if left unaddressed.

Benefit:

- Improves electrical safety by identifying hazardous conditions.
- Prevents fire and shock risks associated

with electrical malfunctions.

- Enhances overall workplace safety and reduces liability.

8. Return on Investment (ROI) and Cost Savings

Though power quality analysis has an upfront cost, the long-term benefits from improved reliability, lower energy consumption, reduced downtime, and maintenance outweigh the investment.

Benefit:

- Generates measurable cost savings.
- Provides justification for electrical system upgrades and mitigation solutions.
- Adds value by improving overall operational efficiency.

9. Supports Renewable Integration and Power Electronics

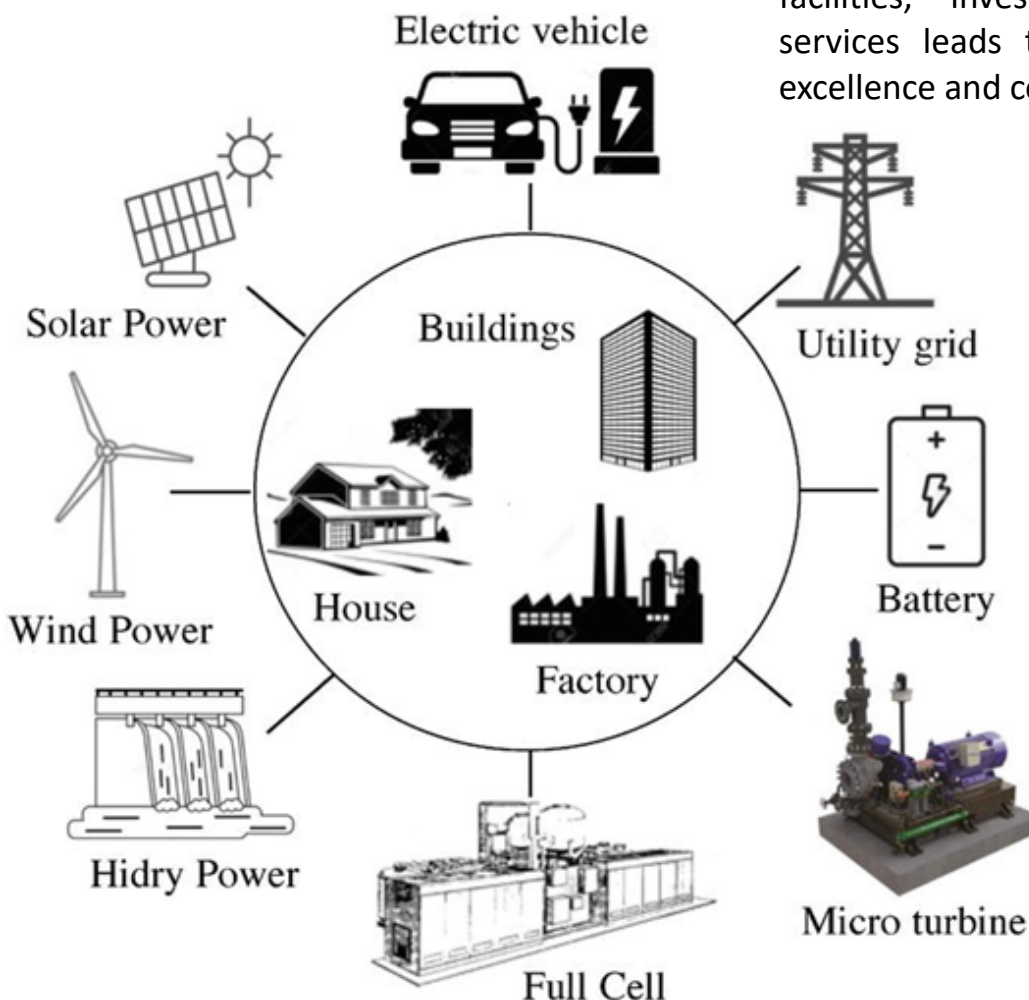
With growing use of solar inverters, EV chargers, and modern power electronics, power quality issues are more common due to nonlinear loads.

Benefit:

- Ensures smooth integration of renewable energy systems.
- Prevents resonance and disturbances caused by inverters and converters. Improves system performance in hybrid power environments.

Conclusion:

Power Quality Analysis Service is not just a technical assessment—it's a strategic tool for improving **system performance, energy efficiency, safety, and business profitability**. For commercial buildings, industrial plants, and mission-critical facilities, investing in power quality services leads to long-term operational excellence and competitive advantage.



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Tips for Going Touchless



Managers with two large institutions discuss the benefits and challenges of successfully incorporating touch-free plumbing fixtures into restrooms.

Automatic, or touchless, plumbing fixtures were a rarity not that long ago, found largely in and handful of airports and convention centers.

In the last decade, however, important changes both in the technology and within facilities have brought touchless plumbing fixtures into all types of institutional and commercial buildings.

A closer look at the issues facing managers in two large institutional facilities reveals strategies for successful specification,

installation and maintenance.

Evolving issues

Three issues have changed greatly in the last decade to pave the way for touchless plumbing technology.

First, the durability and performance of the products has improved, making them more attractive to cost-conscious managers looking for products that need to stand up to high levels of use and even abuse.

“Manufacturers really have done a lot to make their products more reliable,” says Michael Brady, director of maintenance and operations for the Los Angeles Unified School District (LAUSD). The district has been installing touchless plumbing fixtures in its schools.

The automatic control for touchless urinal and toilet fixtures uses an infrared sensor that activates the flushing mechanism only when it is needed and only for one flush. This technology eliminates too-frequent flushing and curtails damage from vandalism to the flush valve.

On sink faucets, touchless controls limit the



flow of water to only when the sensor detects hands under the faucet. This feature can help reduce facilities water use by about 75 percent, and it can reduce damage from vandalism because users cannot leave the water running.

The second issue involves hygiene. Restroom users have become more concerned about the cleanliness of all fixtures and surfaces in restrooms. Because touchless fixtures eliminate the need for human contact, they eliminate the potential for germ transfer. And, when combined with touchless hand dryers and changes in restroom entryways, touchless plumbing fixtures can help managers carry the touchless concept even further.

Third, and perhaps most importantly, water utility costs have skyrocketed in recent years, prompting maintenance and engineering managers to find products and technology that curtail water use. Touchless fixtures, which shut off automatically the flow of water when not in use, address this need.

The fixtures “had been touted as a water-conservation measure, and the utility costs in Boston are quite high,” says Thomas Tribble, P.E., J.D., director of facilities maintenance at Boston Medical Center. The medical center, the teaching hospital for Boston University’s medical school, has 20 buildings with about 2 million square feet of space.

The savings from less post-installation maintenance also were attractive to the medical center. “Even if we hadn’t been ecology-minded, the cost to maintain the existing fixtures would have made us take a look at” touchless fixtures, he says.

Research and selection

The selection process for flushometers at the Boston Medical Center included a test of both the time and the ease of installation of various products.

“We tested several different brands over about a two-month period,” Tribble says. One model required an hour to install, another required about three hours, and still another took more than half a day. Because of the large number of restrooms and installations throughout the center’s facilities, a short installation time was essential.

For the flush meters, Tribble’s department chose a retrofit option from the maker of the existing fixtures instead of completely replacing the fixtures with those from another manufacturer.

“The other units we saw required more work to make the conversion,” he says.

For the faucets, the department opted for a complete replacement. The decision on which manufacturer to go with came down to a matter of batteries, he says. The installed faucets require far less frequent battery replacement than those used by other manufacturers’ models.

The challenge of keeping plumbing fixtures

operational and efficient is immense in Los Angeles’s schools. Brady’s department is responsible for maintaining more than 66 million square feet in 900 facilities, including about 750 K-12 schools. The district also plans to add about 160 new schools in the next few years. This growth means the issue of water conservation in the schools — in Los Angeles and elsewhere in the Western United States — will be increasingly important in coming years.

Renovation planning

In many cases, organizations incorporate the installation of touchless fixtures into larger projects.

“Our goal is to end up with restrooms that are easier to maintain,” Brady says. “We’ll repipe everything if necessary.” Renovations often also include new wall tile, floors, partitions, hand dryers, and lighting. Technicians also have upgraded electrical service to the restrooms to support the use of drain snakes and similar equipment.

The district has budgeted for about 108 student restroom renovations annually, Brady says. So far, crews have renovated about 950 out of 7,200 student restrooms.

At Boston Medical Center, installation started about two years ago on a trial basis. At this point, installations of touch-free fixtures have been limited to the medical center’s public restrooms, not patient bathrooms.

“My goal is to have all fixtures in the hospital totally retrofitted in another three years,” Tribble says.

Targeting vandalism and hygiene

High rates of vandalism in parts of some of LAUSD’s restrooms created a growing number of service requests, and district officials knew

the situation required action.

“We looked at all of the (toilet) stoppage calls and identified high-use areas,” Brady says. In response, the department installed touchless fixtures on toilets to curtail vandalism and minimize service calls because the toilets would flush automatically and more regularly, which also improves hygiene.

In making its fixture selection, the department tested two types of flush valves — hard-wired and battery powered. Hard-wired units created problems during power outages, and they were susceptible to water

infiltration, Brady says. In addition, the higher cost to rough in the hard-wired units caused concerns.

Early generations of battery-powered units also had a few glitches. Batteries in some valves installed in restrooms with windows tended to drain quickly because sunlight repeatedly set off the sensors. Newer models have remedied this problem.

To complement touchless flush valves, eliminate paper and improve restroom hygiene, Brady says, the department also installed automatic hand dryers.

“In 1997, the district started its Smart Restroom program,” Brady says. “Restroom renovations were based on set standards designed to make



restrooms more vandal-proof and to keep them cleaner.” In 2003, another district effort targeted restrooms and aimed to improve hygiene to meet community standards.

While vandalism is not epidemic in the district’s facilities, Brady says, the issue continues to influence the department’s choices of restroom products.

“We have a high rate of vandalism, but it’s primarily in areas that are open to the public and have less supervision,” he says. So far, the department has not installed touchless flush valves on all toilets, nor have they upgraded from traditional sink faucets to touchless fixtures.

The reason? The fixtures on many faucets and toilets remain easier targets for vandals than fixtures on urinals, which are more difficult to reach and kick, Brady says.

To address these challenges, manufacturers are using more durable materials and construction in each new generation of products. Among the remaining vandalism-related problems with the touchless valves are sensor lenses that are susceptible to scratching and convenience-flush buttons that vandals can pry out.

Waterless issues

One of the latest products that aims to reduce water use in restrooms is the waterless urinal. Traditional systems use a water seal to prevent odors generated by the wastewater system from escaping into the restroom. Waterless urinals use disposable cartridges filled with a sealing liquid and, as a result, require no water to operate.

By eliminating valves, sensors and water, these urinals also eliminate problems associated with urinal overflow, splashing and vandalism. The only required service is replacing the cartridge

every six months or so.

The amount of water that facilities can save depends on the application. For example, some users in school have estimated that each installed waterless urinal saves 10,000-40,000 gallons of water annually.

Facilities most often have installed waterless urinals in new construction projects and restroom renovations. Workers can retrofit the urinals into existing restrooms, but they might face problems created by differences in the height of the existing piping and the piping for the waterless unit.

Both Brady and Tribble are researching the performance of waterless urinals in other similar facilities. Neither seems eager to specify the products just yet, however.

Says Brady, “I’ve called other districts, and the reports (on the urinals) are not glowing.” Nonetheless, as with touchless technology, manufacturers of waterless urinals undoubtedly will ensure that future generations of their products address customers’ needs for reliability, maintainability, and cost-effective operation.

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Brief History

- The word Pysanky comes from the Ukrainian verb “to write”
- In earlier times, Pysanky were more than decorative objects. They were believed to be imbued with special powers to ward off evil, encourage marriage and ensure a good harvest; they also protected the household from disaster.
- Traditionally, Pysanky were often gifted at weddings and viewed as gifts of good fortune.



Refrigerants Explained: What Those “R-Numbers” Really Mean in HVAC

Refrigerants are the lifeblood of any HVAC system. The right selection impacts efficiency, system life, safety, and environmental compliance.

Those R-numbers aren't random — once you understand the logic, everything connects.

1. Main Types of Refrigerants:

HCFC (Hydrochlorofluorocarbons)

- Examples: R22, R123
- Medium ozone depletion
- Largely phased out

HFC (Hydrofluorocarbons)

- Examples: R134a, R410A, R407C
- Zero ozone depletion
- High GWP

HFO (Hydrofluoroolefins)

- Examples: R1234yf, R1234ze
- Very low GWP
- Mildly flammable (A2L)
- Future-ready refrigerants

Natural Refrigerants

- Ammonia (R717), CO₂ (R744), Hydrocarbons (R290, R600a)
- Highly efficient, require strict safety

2. Refrigerant Nomenclature – Reading the R-Number

Single-component refrigerants (R-xyz):

- R = Refrigerant

- x = Carbon atoms – 1
- y = Hydrogen atoms + 1
- z = Fluorine atoms
- Remaining atoms = Chlorine (if any)

Examples:

- R22 → CHClF₂ → HCFC, non-flammable
- R134a → CH₂FCF₃ → HFC, non-flammable

3. Isomers – Same Formula, Different Behavior

Some refrigerants share the same chemical formula but differ in molecular arrangement (isomers).

- “a”, “yf”, “ze(E)” indicate structure
- R1234yf vs R1234ze(E) → different pressure, efficiency, and applications
- Same chemistry, different performance.

4. Blends – Mixing Refrigerants

Zeotropic blends

- Multiple components
- Temperature glide exists
- Examples: R407C, R404A

Azeotropic blends

- Behave like a single refrigerant
- No temperature glide
- Examples: R500, R502

Glide must be considered in coil and heat-exchanger design.

5. HCFC vs HFC vs HFO – Simple Logic

- HCFC → Ozone issue ❌
- HFC → Climate issue ⚠️
- HFO → Sustainable solution ✅

6. Safety Classification (ASHRAE 34)

- A1 → Low toxicity | Non-flammable (R22, R134a, R407C)
- A2L → Low toxicity | Mildly flammable (R32, R1234yf)
- A3 → Highly flammable (R290)
- B-Class → Higher toxicity (R717)

Letter = toxicity

Number = flammability

L = slow flame

7. Practical HVAC Application

- Old split AC → R22 ❌
- Current VRF / Split → R410A ⚠️
- New VRF / Chillers → R1234ze / R454B ✅
- Zeotropic blends → consider temperature glide
- Always verify safety class

Key Takeaways





- ✓ R-numbers follow logic
- ✓ Isomers explain performance differences

- ✓ Blends are engineered solutions
- ✓ HCFC → past | HFC → transition | HFO → future
- ✓ Safety and sustainability matter as much as capacity.



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Understanding Refrigerants in HVAC




Types of Refrigerants

<div style="background-color: #e67e22; color: white; padding: 2px; font-weight: bold;">HCFCs</div> <p>R22, R123</p>  <p>Ozone Depleting</p>	<div style="background-color: #f39c12; color: white; padding: 2px; font-weight: bold;">HFCs</div> <p>R410A, R134a</p>  <p>High GWP</p>	<div style="background-color: #34495e; color: white; padding: 2px; font-weight: bold;">HFOs</div> <p>R1234yf, R1234ze</p>  <p>Low GWP</p>	<div style="background-color: #27ae60; color: white; padding: 2px; font-weight: bold;">Natural</div> <p>R717, CO₂, R290</p>  <p>Ammonia, CO₂, Hydrocarbons</p>
--	---	--	--




Decoding Refrigerant Nomenclature

<div style="background-color: #e67e22; color: white; padding: 2px; font-weight: bold;">Single Compound</div> <p style="font-size: 1.2em; font-weight: bold;">R-134a</p> <ul style="list-style-type: none"> --- R = Refrigerant --- 1 = C - 1 --- 3 = H + 1 --- 4 = F atoms 	<div style="background-color: #34495e; color: white; padding: 2px; font-weight: bold;">Blends</div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p style="font-weight: bold;">R-410A</p>  </div> <div style="text-align: center;"> <p style="font-weight: bold;">R-404A</p>  </div> </div> <p style="text-align: center;">Zeotropic & Azeotropic Mixtures</p>
--	--


HCFC vs HFC vs HFO

<div style="background-color: #e67e22; color: white; padding: 2px; font-weight: bold;">HCFC R22</div>  <p>Ozone Depleting Medium GWP</p>	<div style="background-color: #34495e; color: white; padding: 2px; font-weight: bold;">HFC R410A / R134a</div>  <p>Zero ODP High GWP</p>	<div style="background-color: #27ae60; color: white; padding: 2px; font-weight: bold;">HFO R1234yf / R1234ze</div>  <p>Low GWP Eco-Friendly</p>
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Safety Classifications (ASHRAE 34)

<div style="background-color: #e67e22; color: white; padding: 2px; font-weight: bold;">A1</div>  <p>Low Toxicity Non-Flammable</p>	<div style="background-color: #2980b9; color: white; padding: 2px; font-weight: bold;">A2L</div>  <p>Low Toxicity Mildly Flammable</p>	<div style="background-color: #e74c3c; color: white; padding: 2px; font-weight: bold;">A3 / B + 🔥</div>  <p>High Toxicity Highly Flammable / Ammonia</p>
---	---	---

Choose the Right Refrigerant for Efficiency & Sustainability



Q & A:

WD40 for Bearing Lubrication?



"I am being asked by others in my company to start using WD40 as a bearing lubricant. I know that this is not best practice, but I need to explain to them why. Any advice?"

To understand how WD40 might work as a lubricant, we need to first understand its chemical composition. To do this, I went to WD40's Web site. While the marketing pitch lists the ingredients as "secret", the MSDS indicates the following: 60 to 70 percent petroleum distillates 15 to 25 percent base oil and 2 to 3 percent carbon dioxide So it would appear that WD40 is simply a combination of petroleum products, mixed with a propellant (CO₂).

To understand the efficacy of WD40 as a lubricant for the application you stated, we need to compare how the formulation of

WD40 differs from common lubricants designed for use with rolling element bearings. Because you don't mention the exact type of bearing or application, it's hard to be specific; however, a few general comments can be made which pertain to selecting lubricants for rolling elements bearings:

1. The lubricant must have good oxidation resistance to resist sludge and varnish buildup at operating temperatures. While most lubricants are formulated with antioxidant additives to provide this protection, in addition to any natural protection afforded by the use of synthetic base stocks, it appears from the MSDS sheet that WD40 does not contain such additives and would likely degrade and form sludge fairly rapidly if

used at even moderate operating temperatures.

2. You will hear it said that "viscosity is the single most important property when selecting a lubricant". This is particularly true for rolling element bearing lubrication. Viscosity selection is based on a number of factors, including bearing type (ball, cylindrical roller, etc.), speed, bearing size, load and operating temperature. It is usually selected by calculating the bearing speed factor dN and the projected operating temperature. dN can be calculated as follows: $dN = N(d+D)/2$ where N = speed (in rpm) d = bore diameter (in mm) D = bearing OD (in mm). Standard charts are then available to select the viscosity given the dN factor and the temperature. While I do not know categorically what the viscosity of the petroleum distillates or base oil is in WD40, I know from experience (like everyone else, I've used WD40!) that it does not have a particularly high viscosity. So unless this application is particularly high-speed, operating at low to moderate temperatures, it is unlikely that WD40 contains an oil of sufficiently high viscosity to provide adequate lubrication for the rolling element/bearing raceway interface.

One other factor to consider: Depending on bearing design, the roll/cage interface will also likely operate under hydrodynamic conditions. Under these conditions, the typical rule of thumb is for a minimum viscosity of 4 cSt, at operating temperature, to support the load. Again, it is unlikely that WD40 would meet these requirements as a lubricant.

3. Depending on operating environment, the bearing will be prone to corrosion, particularly rusting. Nearly all lubricants contain specific additives, called rust inhibitors to counteract this. Again, the MSDS sheet offers no evidence of such additives in WD40.
4. Depending on bearing design and application, the use of anti-wear additives may be required, particularly where heavy or shock loads are present or where the application dictates possible thrust loading between the end of the rolling element and the raceway flanges. Based on the MSDS sheet, WD40 does not appear to contain such additives, which may result in fatigue and/or adhesive wear. Rereading this response, it is apparent that I'm not particularly enamored with WD40 as a lubricant. My intent was not to be completely negative. WD40 is manufactured and marketed as a household lubricant for those "small jobs" or as a rust remover - heck I have a can in the garage as we speak! For these applications, it does a fine job.

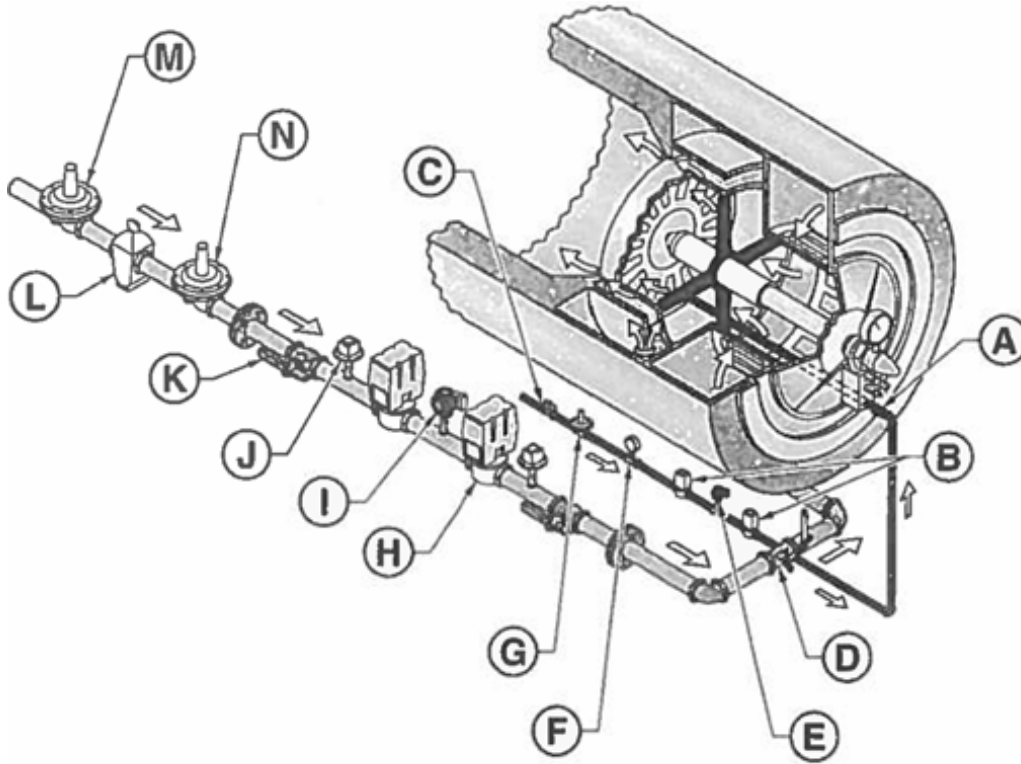
However, WD40 is not sold, nor should it be used as a replacement for the appropriately selected lubricant for rolling element applications in the plant - unless of course we're talking the fan in your computer! I hope this helps!

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High Pressure Gas System

Identify the components of the system:



High Pressure Gas System

- | | | | |
|-------|--------------------------------------|-------|-------------------------------------|
| _____ | 1. Utility meter | _____ | 8. Pilot pressure regulator |
| _____ | 2. Pilot vent valve | _____ | 9. Pilot valves |
| _____ | 3. Main gas vent valve | _____ | 10. Pilot pressure gauge |
| _____ | 4. Pilot adjusting cock | _____ | 11. Main gas shutoff cock |
| _____ | 5. Utility pressure regulating valve | _____ | 12. Pilot shutoff cock |
| _____ | 6. Low gas pressure switch | _____ | 13. Main gas valve |
| _____ | 7. Butterfly gas valve | _____ | 14. Plant pressure regulating valve |

KenKen Puzzle

How to solve the KenKen puzzle:

(Answers on page 32)

- 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 is in the same row or column

9	8			4		5	3	
					8	2		7
2	5		3		6		4	8
5	6		1					4
7	2		9	8			1	3
				6	7	9		
4			8	3				2
		2				4		
	1	6	2		4	3		9



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Kenken Puzzle Answer

9	8	1	7	4	2	5	3	6
6	4	3	5	1	8	2	9	7
2	5	7	3	9	6	1	4	8
5	6	9	1	2	3	8	7	4
7	2	4	9	8	5	6	1	3
1	3	8	4	6	7	9	2	5
4	9	5	8	3	1	7	6	2
3	7	2	6	5	9	4	8	1
8	1	6	2	7	4	3	5	9

TEST YOUR OPERATOR IQ ANSWERS

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



Just for laughs!



What did the fish say after
it swam into a wall on
April Fools' Day?

Dam.



What do you call a hammer
bought on April 1st?
An April tool.

Parade



Knock, knock!
Who's there?
Otto.
Otto who?
**You otto know April
Fools' is on April 1.**



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PRESENTER: Doug Houg
Exel Systems

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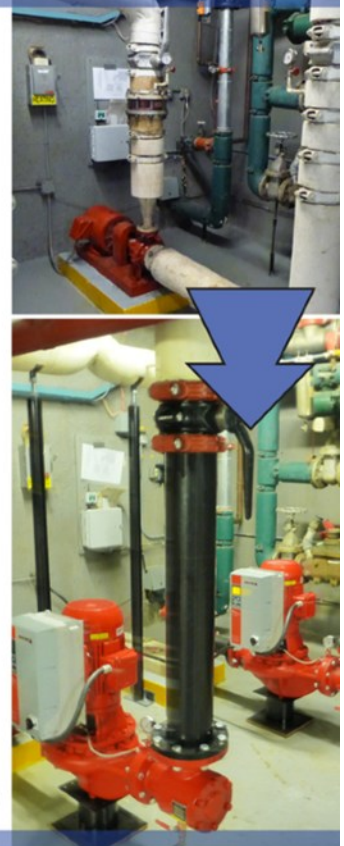
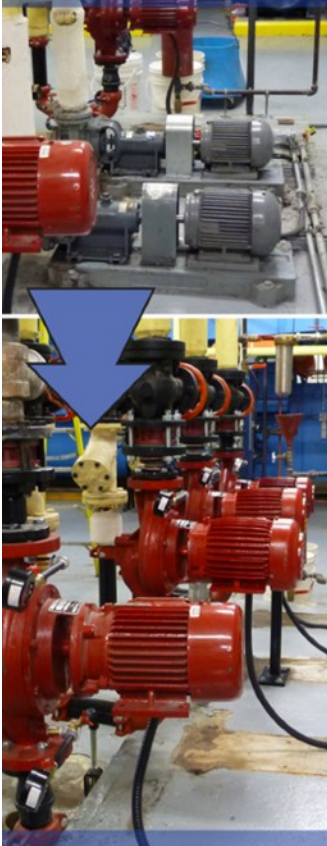
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