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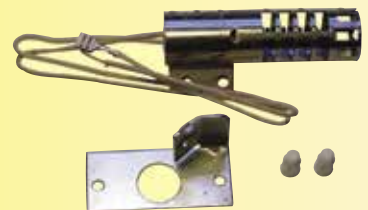
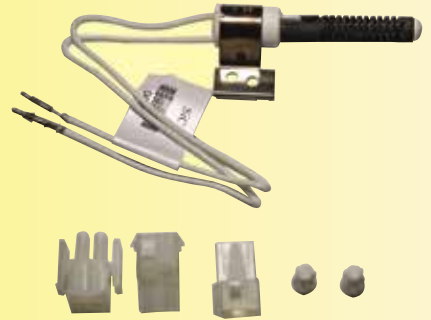
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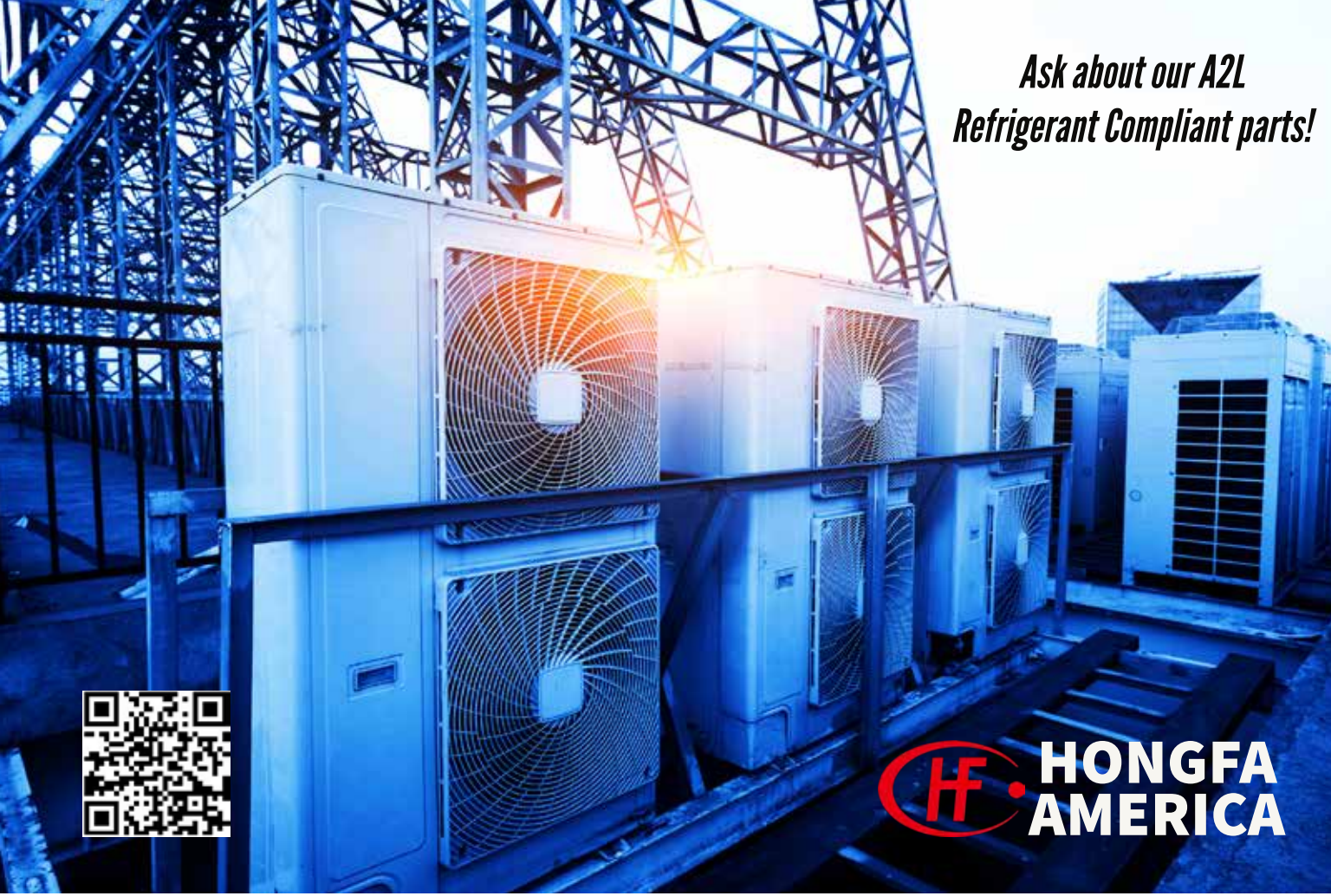
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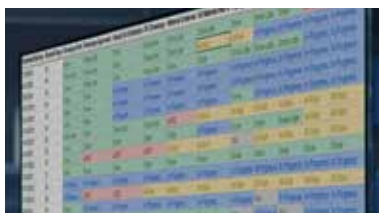
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2025 IS HERE

Welcome to 2025. This is our first of four, quarterly issues. Whether you are reading us digitally or print copies (which are available at the AHR show) thanks for taking the time to spend time with our product.

AHR is the most important show for our industry. Held annually in various locations, the 2025 event returns to Orlando February 10-12. And as usual we will be there, meeting with readers (mostly design engineers) new subscribers and advertisers. All depend upon us to deliver technical information that will assist the design engineer in performing their job.

Why the design engineer? Because as a supplier to OEMs, companies want design engineers to "buy, specify or recommend" their products and services before the manufacturing process begins.

As usual we have a broad spectrum of feature articles. Here are the six companies who have submitted:

Bosch Home Comfort, Chemours, Davi, Littelfuse, Lumberg, Sensata and Vitrek

The reach of our brand never fails to amaze me. One example? In December, when this column was written I was contacted by a reader in Iran who applauded our efforts

From a different perspective, a lot has been in the news regarding tariffs on products coming into the US from various countries, particularly China and Mexico. While it remains to be seen if that will happen, and if so what the magnitude of those tariffs would be, it's an important issue to be aware of. Many components that are included in appliance and HVAC products are sourced from other countries. Tariffs will raise the cost to manufacturers, and will leave the OEMs little choice but to pass all, or at least some of these costs, to the ultimate buyer...both on the consumer and commercial sides.

Hope to hear from any of you who have questions, suggestions, etc. My email is brad@appliancehvacreport.com

Thanks and have a great 2025!

Brad Glazer

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APPLIANCE & HVAC
REPORT Reaching Design Engineers at the OEM Level

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OEM Level

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How to Keep Your Engineering Team Accountable and On Time

For Engineer to Order manufacturing operations, visibility and accountability to target dates are as important in the engineering department and stages of the project as it is in production. In the production side of things, the status of jobs is self evident, but that's frequently not the case with the engineering parts of the project.

Delays or missed deadlines in engineering results in production getting a bad or late start, and most of this is avoidable with a simple dashboard visible to all, that includes target completion dates for all the stages from design, customer sign-off, manufacturing drawings, through production stages and all the way to the "as built" drawings. Failing to make all the target dates (including engineering stages) visible and obvious to everyone inevitably results in failing to meet target dates, period.

In many "E to O" manufacturers I visit, there are engineering managers and production managers, and in larger organizations, there may also be project managers. In smaller organizations the role of project manager frequently defers to the company owner, or to the person that made the sale and is the primary project 'driver' - the person that wants to see the product or project delivered on time so they don't have to deal with a grumpy or



unhappy customer later.

Visibility and accountability only happens in weekly update meetings involving engineering, production, management and sometimes the salesperson. These meetings are supposed to keep the project on track, but in reality, most of the time spent in these meetings is spent on explaining why certain things didn't happen or weren't completed when they were supposed to have been, and targets for the uncompleted tasks are pushed out another week, where it is likely they will be pushed out again.

On the production floor, there is a natural urgency that builds day by day if a project stalls, but in engineering, the urgency is only evident and visible in the weekly update meetings.

It's not that the engineering department isn't busy or working hard, or spending their time 'productively' (ie. doing engineering work on the projects); most of the

time that

I've observed a chronic failure to deliver on time is due to one of two causes: the first is not working on the right project at the right time, and second is spending far more time than planned working on elements of a project.

The easy remedy for both of these things is a simple dashboard that lists the projects underway with milestones, or 'weigh points' (to borrow a mariner's common navigation term), to make sure each project is arriving at the appropriate 'weigh points' on time. Failure to arrive at a predicted weigh point is an early indicator that the end point of the project won't be reached on target either.

Dashboards do three things: the first is they help people in engineering **focus** on what they need to be **doing now**; the second is they help engineering team understand the **cascading effect** of their efforts and how it affects every other department; and the third is

as an **early warning** system that allows changes and adjustments to be made to either get back on track, or **avoid** additional and **compounding delays**.

Dashboards don't have to be difficult, cumbersome, or part of an expensive end to end business or project management system. In fact, they can be simple, inexpensive and easy to deploy. For an example, checkout www.tpi-3.ca/dashboard It has a spreadsheet-like feel that engineers

and manufacturing people will feel comfortable with and can be up and running in less than an hour. Plus, it's very inexpensive, and brings visibility and accountability to whole team right away.

Perhaps you have an ERP or project management software that has tools built in, but aren't yet using them effectively, or they're not really visible and understandable to all. If they're not those two things (visible and understandable), they won't drive

accountability, nor are they likely to cause any change of personal, team, or company behavior.

Without accountability and visibility, it becomes a **repeating cycle of late deliveries**, increased overtime and stress to keep customers happy (or less unhappy), which often affects the on-time start of the next project. And so it continues; profit is lost on every job that is late, capital is tied up longer than necessary, people are stressed and feel overworked, and overall production capacity is diminished.

Effective Dashboards have **immediate** and **lasting** effect. They inform people, engage people, and keep everyone on the same page. To continue your investigation on this topic, don't forget to check out www.tpi-3.ca/dashboard and look for a link to try it out for yourself. Or send us a note and we will walk you through it.

Paul Hogendoorn can be reached at paul@tpi-3.ca For more on what Paul's company does, check out www.tpi-3.ca



Project/Deliverable	Expected Date	Drawings Sent	Drawings Approved	Ready for Schedule	IFC Drawings	Material Ordered	All Material Rec'd	Piping	Vessel	Structural	Assembly
10-10-2023	45	Done	Done Late	Done	Done Late	Done Late	Done Late	At Risk	Done Late	Done	LATE
10-11-2023	45	Done Late	Done Late	Done	Done Late	Done	Done	In Progress	In Progress	In Progress	In Progress
10-12-2023	46	Done	Done Late	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress
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How to Design Smart Major Appliances for IOT Homes

Essential factors to consider: Ensuring safe, efficient, and robust products

Advanced electronic technologies and innovations appear in all electronic and electromechanical devices, including the common consumer appliance. IoT technology and advanced sensing technology are making appliances smart. They can operate under remote control and provide status indications on numerous parameters for diagnostic information and predictive maintenance. These advances

significantly increase the electronic circuitry in new appliances.

The designer's challenge is to develop a reliable appliance with the added complexity of the greater electronic content. That requires protecting the circuitry from overcurrent conditions, voltage transients, and electrostatic discharge (ESD). Also, the design needs efficient and robust sensing and control to minimize power consumption. Figure 1 displays a range of appliances, all of which require circuit protection and efficient control.

This article informs designers about protecting their appliance circuitry from electrical hazards.

It also provides recommendations for control and sensing for optimal appliance operation and introduces the designer to some unique components that will help reduce component count and simplify the task of ensuring circuit protection and efficient control.

Washing machine overview

The washing machine will serve as the major appliance example for presenting recommendations to ensure safe, reliable, and efficient operation. Figure 2 presents an overview of the components that enable a robust and efficient washing machine.



Figure 1. Major appliances share common design principles with all appliance types



Figure 2.
Components recommended for safe and efficient operation of a smart washing machine

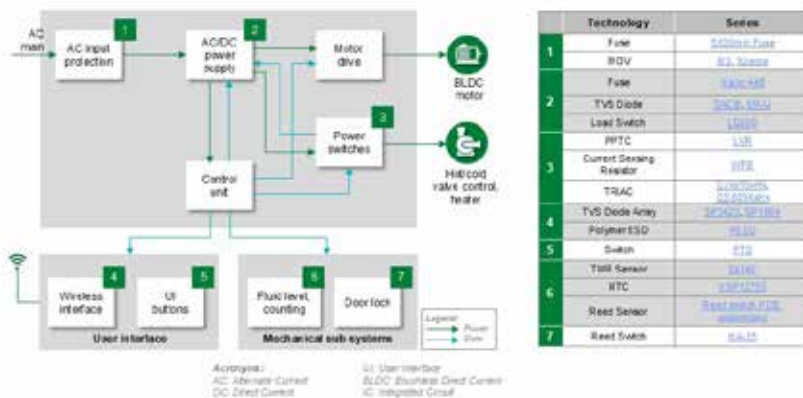


Figure 3. Smart washing machine block diagram with recommended components

Figure 3 details the circuit blocks in a smart washing machine. The table lists the recommended components and shows which circuits use them to ensure safe and efficient operation. Most of these circuits are also elements of other appliances as well. The Motor Drive circuit powers the drum and the agitator during the wash, rinse, and spin cycles. The Power Switches circuit powers the water pump, the water valves, and the water heater during the stages of the wash cycle. The Control Unit controls both circuits. The Control Unit receives input from the User Interface and Mechanical Sub-Systems circuit blocks.

Protecting the washing machine

The washing machine obtains its

which can deliver high current and apply high voltage transients to all products connected to the power line. Both overcurrent protection, transient voltage protection, and ESD protection are required to protect appliances such as washing machines from damage due to these electrical hazards. The following paragraphs describe the circuits requiring protection.

AC Input Protection circuit

The AC Input Protection circuit should have components to protect from overcurrent and overvoltage. A fuse can provide overcurrent protection to protect the washing machine from either a short circuit in the load or the appliance itself. Without a fuse, the AC power line will deliver a significant surge of current that will damage the

appliance. The heat generated could lead to a fire. Consider a time lag fuse that avoids nuisance openings due to inrush currents. The selected time lag fuse should have the following:

- An ampere rating as defined by the design requirements for the appliance
- A voltage rating that exceeds the maximum AC line voltage
- An interrupting rating at least 10 times the ampere rating
- Compliance with IEC 60127-2 and UL/CSA 248-1 and 248-14 safety standards.

As with potential damage from an overcurrent condition, transients induced on the power line impinge on the appliance and can destroy the electronic circuitry. Damaging transients can result from lightning and large inductive loads, such as motors switching on and off. Use a metal oxide varistor (MOV) for protection from transients. Place the MOV after the fuse but as close to the AC power entry point as possible. Select an MOV that:

- Withstands a voltage pulse of at least 1 kV
- Absorbs a peak current pulse of at least 1200 A
- Compliant with UL 1449 and IEC 61051-1 and 2.

AC/DC Power Supply

The AC/DC Power Supply is typically a switch-mode power supply that generates the DC voltages required by the control and power drive circuitry. For this circuit, a fast-acting fuse will provide secondary overcurrent protection for the supply and downstream circuitry. Since this fuse sees AC line power, ensure the selected component is compliant with UL/CSA 248-1 and 248-14. Also, minimize power loss using a fuse with low cold resistance, which can be under $1\ \Omega$.

A transient voltage suppressor (TVS) diode will protect the power

supply from portions of transients that propagate through the AC Input Protection circuit. TVS diodes are available with the capability to absorb peak power pulses as high as 500 W. In addition, TVS diodes have:

- Electrostatic discharge (ESD) protection up to 30 kV
- Clamping voltages as low as 10 V
- Extremely fast response times of under 1 ps
- Bi-directional or uni-directional models
- Compliance with IEC 61000-4-2.

Power Switches circuit

The Power Switches circuit controls the water valves, pump motor, and heater if the washing machine has a water heater. In this circuit, a fuse protects the external load devices from an overcurrent condition. Consider a polymeric positive temperature coefficient resettable fuse. This type of fuse has fast trip times and can operate in circuits with voltages as high as 240 VAC or 240 VDC.

Wireless Interface circuit

The Wireless Interface supplies cellular and Wi-Fi links for communication with the appliance. The most significant risk to this circuit, which is exposed to the external environment, is from ESD and lightning. A TVS diode array, as shown in Figure 4, can provide the necessary protection. TVS diodes with capacitance as low as 0.2 pF on each I/O line to minimize RF transmission and reception disturbance are available. The diodes can provide at least 10 kV of ESD protection.

An alternative to the TVS diode is a polymer ESD suppressor. These components offer ESD protection to 15 kV for a through-the-air strike. They have a low capacitance of 0.25 pF, independent of frequency, and a very low leakage current of under 10 nA.

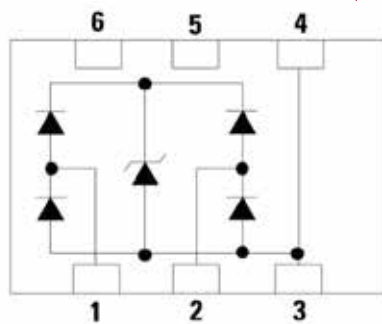


Figure 4. 2-channel TVS diode array with surface mount packaging



The set of components described supplies the protection the washing machine needs to be robust to electrical hazards. The design requires only six components.

Efficient control of the washing machine

A prudent selection of components and sensors can minimize power consumption and offer unique solutions for sensing essential parameters. The following paragraphs detail components that provide important sensing functions and impart efficient control functions in the various circuits.

Power Switches circuit

A current sensing resistor in the heater circuitry can provide feedback to the Control Unit for water temperature control. Current sensing resistors can have low resistance under 60 mΩ to minimize power loss in the control circuit. The tolerance on most of these resistors is 1%. Their power ratings can be from 1 W to 3 W, and their temperature coefficients can be as low as 50 ppm/°C. Current sensing resistors with surface-mount packaging can save PC board (PCB) space.

Consider efficient TRIAC solid-state switches to control the water heater's power. Models are available with low gate power dissipation of approximately 0.5 W. They can have on-state current ratings of 16 ARMS and a blocking voltage of 600 V. Look

for a TRIAC with a high operating junction temperature of 150° C.

TRIACs can also control power to the hot- and cold-water valves. To withstand inductive transients, models can have high voltage ratings of 800 V and high surge currents of 55A. Gate power dissipation can be as low as 0.3 W.

User Interface

Designers can customize switches for the specific requirements of their appliance. They can use long-life, reliable, tactile feedback switches for the cycle control and other function settings. The switches should be sealed with at least an IP 40 rating against moisture and dust ingress. Switches can have resistances under 100 mΩ to minimize power consumption. Depending on the switch selected, operating life can be 200,000 to 5 million cycles. Other options include actuator style, switch height, termination, and actuator force.

Unique sensors for mechanical sub-systems

Water level monitoring is an essential feature of a washing machine. Consider a tunnel magnetoresistance (TMR) sensor for water level detection. Figure 5 shows one TMR sensor model. The TMR sensor provides a one-IC solution for sensing and signal conditioning. It also offers:

- High sensitivity of 17 Gauss

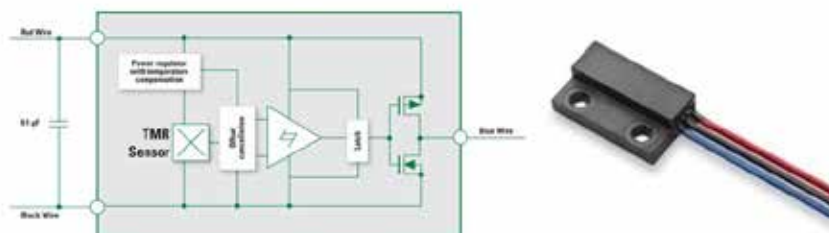


Figure 5. Tunnel Magnetic Resistance (TMR) Sensor

- Low power draw of only 1.5 μ A
- IP 67 rated
- Interfacing with digital control levels from 1.8 V to 5 V
- Long life with up to 20 billion operations.

A TMR sensor like the one shown in Figure 5 uses a single IC to simplify level detection and data transmission.

An alternative to a TMR sensor is a customized reed sensor. Littelfuse offers a customized design service to enable designers to meet specific requirements for part geometry, material used, magnetic sensitivity, electronic circuitry, and mechanical components. Customized reed sensors are a less complex technology than TMR sensors. Also, the reed sensor does not consume any power when in its off state. Unlike the TMR sensor, the reed sensor design can allow switching load current. Figure 6 shows all the steps Littelfuse can use to create a custom design.

The two options give designers substantial flexibility in designing water-level detection systems. The TMR sensor or a customized reed sensor can provide an excellent

solution.

Consider a thermistor probe assembly for water temperature monitoring. Thermistors can provide sensing over the -55 to +105° C range. House the sensor in a stainless-steel probe.

For user safety, the design must ensure that the washing machine cannot operate unless the door or top is fully closed and engaged. A reed switch and a metal actuator on the door provide a simple, low-power solution. Use a hermetically sealed reed switch, which can have sensitivities ranging from 17 to 33 Ampere-Turns.

Collaborate with experts for a robust, efficient product

Protection against electrical hazards such as overcurrent, overvoltage, ESD, and overtemperature is critical for ensuring reliable operation. Minimizing power consumption is also an essential design goal. The recommended components enable designers to develop safe, reliable, and low-power-consuming major appliances.

Designers should utilize the component manufacturers' application engineers to ensure they develop a robust and efficient product to save design time and compliance costs. The application engineers can help with the following:

- election of cost-effective protection, sensing, and high-efficiency components
- Knowledge of the applicable safety standards
- Some companies, such as Littelfuse, can perform pre-compliance testing to avoid compliance test failures and save on delays and added costs for multiple compliance test cycles.
- Collaborating with the component manufacturer's application engineers and using the recommended components will help to produce robust, reliable, and efficient, smart appliances.

References

Additional recommended resources, courtesy of Littelfuse, Inc.

- *ircuit Protection Product Selection Guide, 2023*
- *Sensing Products Selection Guide, 2023*
- *C&K® Switch Product Selection Guide, 2024*
- *Power Semiconductor & IC Selection Guide, 2024*
- *Integrated Circuits Selection Guide, 2024*
- *Fuseology Design Guide, 2022*



About the author
Paulius Juskevicius is a strategic marketing manager for the electronics business unit at Littelfuse. Paulius joined Littelfuse in 2016 as a field application engineer

for the EMEA region. His current responsibilities include managing marketing activities for new product launches and performing marketing studies and feasibility analysis for new product ideas. Paulius earned his master's in electrical engineering from Kaunas University of Technology.

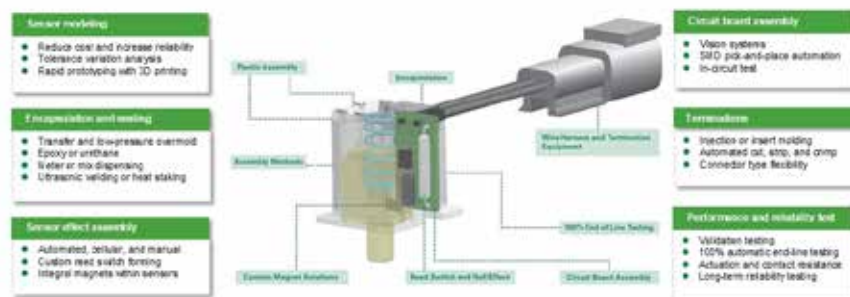
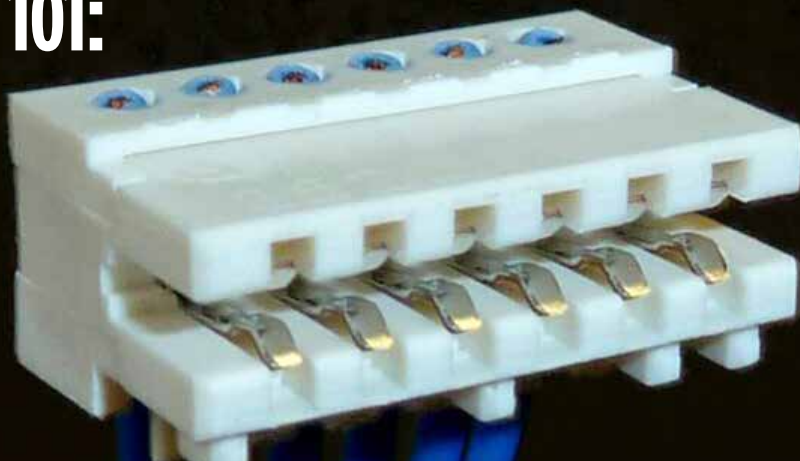


Figure 6. Custom magnetic sensor design considerations

RAST Connectors 101:

A European design now influencing North American Appliance & HVAC



Manufacturers of appliances and HVAC products in North America face a complex challenge today in the design of the PCB and wire harnesses. The emergence of smart features in appliances requires the board design to use more connections than ever before, while making the product more energy efficient. Furthermore, manufacturers are looking for ways to reduce cost and time in board assembly, as traditional crimp contacts can be time-consuming. To meet these modern challenges, North American OEMs have begun to consider the integration of RAST-style electrical connectors. Although RAST connectors are relatively unknown in the North American, these connectors have been the standard in European design for appliances and HVAC products. In this article, we will explore the benefits of RAST connectors, and how they can be utilized to overcome challenges in PCB and wire harness design.

The History of RAST

In the 1980s, appliance manufacturers in Europe had a major issues with using hybrid technologies on their board design. Since every connector manufacturer

had their own design for the connectors, the OEMs would either have one of two options. They would design new products with whatever legacy connectors they were familiar with, or they would have to start from scratch with a different connector design. This not only made board re-design difficult, but also limited any options for sourcing on existing designs. Several major appliance manufacturers across Europe formed a committee to create a solution. This committee gathered a group of electrical connector manufacturers, who were tasked with creating a standardized connector design. The connector manufacturers among this group were Lumberg, Molex, Stocko, Wieland, and AMP. In 1986, the first RAST 5 designed. Since then, RAST connectors have become the standard connector type for appliances and HVAC products in the European market.

What is RAST?

RAST stands for "Raster Anschluss Steck Technik", or "Pitch Connection Plug Technology". The name refers to the standardized design of the connector class itself. For example, a RAST 5 connector has a 5 millimeter pitch between each pole, while a RAST 2.5 connector has a 2.5 millimeter pitch. These connectors can be placed

consecutively without loss in pitch.

The "standardized" nature of RAST means that multiple suppliers are manufacturing these connectors with the exact same design. This allows a great deal of flexibility for OEMs, since they can use multiple suppliers that share the same one-to-one design on their connectors.

Many RAST connectors also utilize IDC (Insulation Displacement Connection). These types of connectors have small, v-shaped blades inside the poles. When the wire harness is processed, these blades cut into the wire insulation and make the connection. However, other connection types, such as screw terminals, are also available for RAST connectors.

In the appliance and HVAC markets, the most commonly used types are RAST 2.5 (which handles a current up to 6 A) and RAST 5 (up to 16 A). However, in recent years the RAST portfolio has expanded for both larger and smaller applications. The RAST 7.5 connectors handle a current up to 25 A for higher-power applications. Meanwhile, the RAST 1.5 can be used for rated current up to 3 A, while saving 43% of footprint on the PCB. This is especially useful for appliance PCB design, where efficient use of the board space is crucial.

RAST connectors meet all typical certifications, such as RoHS, UL, CSA, VDE approved, and glow wire.

Benefits of RAST

The modular design of RAST connector creates numerous benefits for PCB design. Since RAST connectors are well established in the industry, there are many different types and pole counts to fit any particular application. This allows for more flexibility in board and harness design, and reduces development time. RAST connectors also utilize "keying" options, meaning that each connector will fit into the spot on the board that it is designed for, thereby reducing mating errors in assembly.

The use of RAST connectors can reduce overall cost through several factors. For example, RAST connectors have the option to be connected directly to the edge of the board, rather than requiring a header on the board. While both options are available, utilizing edge connections can reduce cost and complication

in a board design. Also, since RAST connectors usually use IDC-type connections, it eliminates the need to strip and crimp wire. Not only does this save labor, but it creates a reliable connection for high-vibration environments, such as the spin cycle on a washing machine. Lastly, RAST connector are designed for smaller wire diameters than traditional crimp connectors, allowing wire harness makers to save cost on the wire as well.

The use of RAST connectors also allows for a greater degree of automation for wire harnesses processing. Suppliers of RAST connectors also provide a range of harness processing tools to meet production level need, from simple hand tools to fully automatic machines. No matter what level of production is needed, these tools and automation ensure that quality wire harnesses are created consistently and reliably.

Conclusion

As North American design engineers begin to adopt RAST-style connectors, the benefits become more apparent. Initially designed for the appliance market, RAST connectors have not been adopted across many other applications such as HVAC, automotive, and industrial machines. Especially in the appliance industry, the consumer base in North America is willing to pay a premium for sturdy, low-maintenance products. Therefore, it is important for OEMs to consider reliable connectors for their designs. As designs in the appliance and HVAC industries become more complex, the flexibility of the RAST connector has helped some the world's largest manufacturers design quality products.

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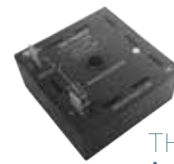
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A2L and New Refrigerant Strategies Take Holistic View of Environmental Impacts



Across nearly every industry worldwide, there has been a continued push for fuel and energy efficiency – along with a reduction in global warming impacts. The heating, ventilation and air conditioning industry has been a focal point of that trend.

The U.S. Energy Information Administration estimates that the energy used to cool residential and commercial buildings accounted for a full 10 percent of total electricity consumption. The latest push in the industry to help reduce electricity use and greenhouse gas emissions is the shift to A2L HVAC systems featuring new refrigerant types designed to be both energy efficient as well as less impactful toward global warming.

The use of advanced A2L refrigerants – and their widespread use – will help drive a continued reduction in greenhouse gas emissions and continue a push for a healthier world.

The Push for A2L - Regulatory and Historical Background

The processes which set the stage for the development of A2L refrigerants go back to the late 1970s and early to mid- 1980s, when scientists studying the thinning of the ozone layer in Earth's atmosphere discovered the impact man-made chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) were having on the planet.

Those discoveries ultimately led the way to the creation of the Montreal Protocol through the United Nations, which was adopted in September of 1987. To this day, it is the only treaty which that has been ratified every country on Earth - all 198 UN Member States.

That treaty created a phase-down schedule for

almost 100 man- made chemicals designated as ozone depleting substances – many of which had been traditionally used in refrigeration and air conditioning contexts. Under that schedule, developed countries completed phased out HCFCs by 2020, and developing countries operating under a timeline of 2030.

Introduced to replace those ozone-depleting chemicals in many cases were another group of substances - hydrofluorocarbons (HFCs). While they did not have the same negative impact on the ozone layer, these chemicals did still have elevated global warming potential (GWP), creating an outsized effect on global warming.

To address that aspect of the dynamic, the United Nations developed the Kigali Amendment in 2016, which would look to phase out HFCs over time, reducing their use by 80 to 85 percent by the late 2040s in developed countries. Many European countries have taken independent actions, and the United States ratified the agreement in September 2022.

Overall, the trend in refrigerant technology and approach over the past 40+ years has been the continued movement toward systems with a reduced GWP and overall lower environmental impact.

Breaking Down Environmental Impact of Refrigerants

The environmental impact of refrigerants – and why the A2L category is coming into focus – comes back to the holistic impact those chemicals have on the environment.

In this context, chemicals are generally classified in terms of both flammability and toxicity according to ISO 817.

Chemicals in category A3 are considered less toxic, but highly flammable – such as propane. While chemicals at B1 may not be flammable, they are toxic. A2L chemicals are slightly flammable but are less toxic.

The third factor to consider is how efficient and effective a chemical is for a given purpose. After all – most of the environmental impact of HVAC equipment – about 70 percent – is in their power consumption (and the energy generation processes used to provide it).

Holistically, the goal is to find the balance between a chemical's global warming potential (GWP) and its efficiency in use in an HVAC environment while also considering flammability, toxicity, or other issues.

While legacy hydrofluorocarbons did provide strong efficiency in HVAC systems for their time, they carried extremely high GWP rates, in addition to the ozone depletion issues discussed prior. Many A2L refrigerants developed in the years since deliver stronger HVAC performance without those ozone-depleting or greenhouse gas side effects.

Other chemicals – such as propane, CO₂, or ammonia – have also been used in this application, but each of them has issues which stand as barriers to truly widespread use. CO₂ systems operate at 5 to 10 times higher pressure than other systems and may not be permitted in some context, propane is extremely flammable, and ammonia has the potential to be highly toxic.

That concept of finding the right balance between GWP, safety, and cooling efficiency is the genesis behind the A2L category, and its use within the HVAC context.

Codifying A2L HVAC Systems in Buildings

A2Ls have been used in the European Union, Japan, India, Australia, and the auto industry for some time. But as the advantages of using A2L systems became more clear, regulatory bodies made adjustments to account for their use in commercial and residential HVAC systems, such as ASHRAE 15-2019 and UL 60335-2-40.

In order to burn, A2L gases would need to leak, reaching concentrations above the chemical's lower flammability limit, and then be exposed to an open flame or other ignition source. To prevent this, much of the regulatory focus has been on the preventing and detection of leaks within a given system.

Systems designed to operate with A2L refrigerants must be designed

so they cannot operate if leak detection systems are bypassed. Those same leak detection systems must withstand very challenging environmental conditions – high in condensation with significant temperature extremes – without needing additional maintenance or calibration over a planned 15-year equipment life. In addition, many chemicals used in servicing HVAC equipment may use oils or other chemicals which may foul some detection systems.

The final – and perhaps biggest – challenge for HVAC OEMs is that these new designs are an added cost to each system where the end consumer does not immediately see the return (as opposed to a more efficient system costing less to run). This puts an additional focus on making sure the refrigerant

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detection system is robust and will not either require additional maintenance or impact the unit's working life.

Sensata's Resonix™ RGD sensor is the end result of a detailed design plan to deliver the reliability and performance OEMs expect for these systems.

The sensor uses acoustic resonance technology to continually monitor for the target gas within the HVAC system – often near the condenser coil, where leaks may be most likely to occur.

It delivers a fast response with a life expectancy greater than 15 years – often longer than the equipment itself. Because they do not require field calibration or re-zeroing, they reduce service costs for both installers and end users.

As these flammable refrigerants continue to expand, this need will also become more widespread. Regulations for managing leak

detection for propane (R290) systems are already in motion, and other platforms will almost certainly be there in the future.

Looking forward with Refrigerant Technology

Stretching back more than 40 years, the continuing arc of HVAC technologies has been the continued push toward more environmentally friendly technologies and refrigerants – a trend which will likely continue to take shape in the coming decades.

Actions taken under the Kigali Amendment to reduce and eliminate the use of HFCs is expected to prevent more than 100 million tons of carbon dioxide equivalent of greenhouse gases from the atmosphere. By 2100, that effort will have hopefully helped to avoid up to 0.5 degree Celsius of global temperature rise.

Looking ahead, further

enhancements in HVAC system design throughout the coming years and decades will continue to take shape, governed by that ongoing focus on safety, environmental impact, and energy efficiency worldwide.

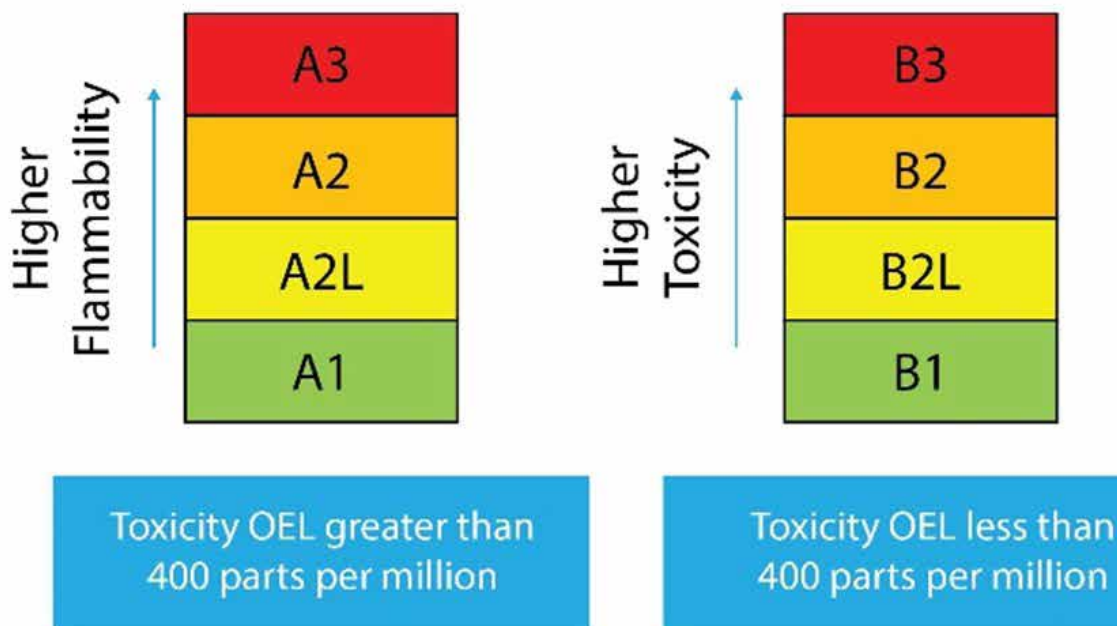


Richard Rodriguez is the Senior Global Product Manager for Sensata Technologies' HVAC Gas Sensing product line. Richard has 15 years of product development experience in industrial sensing, professional lighting,

environmental sensors, and additional product categories.

Captions: ISO 817 Chart showing flammability and toxicity standards

Caption: Sensata Resonix™ RGD Refrigerant Leak Detection Sensor





R454B—Similar Performance, 78 Percent Lower GWP

The HVAC industry is in the middle of a once-in-a-generation transition from legacy refrigerants to A2Ls. Named for their ASHRAE safety classification and characterized by mild flammability, A2Ls' "headline" is that they offer significantly lower global warming potential (GWP) than the hydrofluorocarbons they are designed to replace.

The industry widely understands the role regulatory requirements have played, and will continue to play, in the innovation and manufacturing of A2Ls and A2L equipment. However, change typically comes with some degree of challenge. This is why, for more than a decade, Chemours has collaborated with industry partners to not only determine the optimal solution for the A2L transition—but to ensure HVAC contractors have the knowledge, technical support, and supply they need to make the switch confidently and on-point with their business strategies. Working with OEM partners has enabled engineering that helps minimize design change and, in some instances, allows components to remain the same. All this works to support a smoother A2L transition for contractors and others in the industry.

Better for the environment—but what else?

In terms of new-generation solutions for HVAC, Chemours Opteon™ XL41 (R-454B) offers the lowest GWP of all commercially available R-410A replacements for air conditioners and chillers. With an AR4 GWP of 467, R-454B delivers an approximate 78 percent reduction in GWP compared to R-410A. As the industry commits to reducing its environmental footprint, R-454B certainly stands out for its low GWP. However, contractors transitioning to R-454B equipment need to know more about it. Here are answers to questions Chemours is consistently asked about Opteon™ XL41:

1. *What applications is it suited for?*

Applications include residential, light commercial, and commercial positive displacement; direct expansion chillers and air conditioning; window units and portable AC; heat pumps and chillers; mini-split and ducted-split units; and Packaged Terminal Air Conditioners.

2. *What are the similarities to R-410A?*

Opteon™ XL41 offers similar pressure-temperature profiles, thermodynamic properties, material compatibility, and system architectures. It also offers exact oil type/compatibility.

3. *What are other advantages of working with it?*

It offers excellent performance in normal and high ambient conditions; it is easily convertible in new equipment from R-410A design with minimal changes; very low temperature glide; and it is miscible with POE lubricant.

4. *Aside from lower GWP, how does it support environmental priorities?* Unlike many so-called "naturals"—like CO₂ and propane—R-454B and other A2Ls can be recovered, reclaimed, and reused and are critical to advancing circularity across many industries. They also support the path to decarbonization.

80 percent of major air conditioning OEMs in the U.S. have selected R-454B

An increasing number of OEMs are optimizing designs for R-454B. "Opteon™ XL41's similar performance characteristics to R-410A made for a smooth transition for our lab technicians and assembly line associates—training was minimal," said Chris Forth, Vice President of Regulatory, Codes & Environmental Affairs, Johnson Controls at Johnson Controls Residential and Light Commercial.

Remember that the A2L transition is industrywide. No matter the size, location, needs, or goals of your business, ample resources exist to help you formulate the right A2L strategy. For more information and support—including on-demand A2L training—visit opteon.com.



About Christina Spalding, Americas Sales Manager, OEM and Aftermarket - Thermal & Specialized Solutions, The Chemours Company, FC, LLC
Christina draws on more than 25 years of experience

in the refrigerants industry to provide a diverse range of customers solutions rooted in tried-and-true chemistry formulated for today's most demanding performance and environmental needs. After obtaining her Chemical Engineering Degree from the University of South Carolina, Christina began a career journey that gave her expertise in both Stationary and Mobile refrigeration applications, and established her appreciation for the critical ways refrigerants support society, given their roles in comfort cooling, food storage, food transportation, medicine, cold storage, and all applications that require temperature control. Over nearly three decades, Christina has supported the industry through every major transformation—starting with the transition from ozone-depleting refrigerants (HCFCs) to non-ozone depleting refrigerants (HFCs), then from HFCs to lower global warming potential (GWP) HFOs.



A2L Transition: Safety Considerations for Handling R-454B

With the Environmental Protection Agency (EPA)'s updated manufacturing guidelines mandating the use of A2L refrigerants in new HVAC production now in effect, R-454B has emerged as the environmentally friendlier, new refrigerant of choice for the industry.

Widespread adoption of R-454B and other A2L refrigerants will mean embracing some new and improved safety procedures alongside evergreen best practices to optimize system efficiency and installer safety.

A2L-Specific Safety Considerations

While A2L refrigerants like R-454B boast lower toxicity than R-410A, they are slightly more flammable. R-410A has no flame propagation – so even in the case of a leak, a lit fire wouldn't spread.

In contrast, R-454B and other A2L refrigerants – considered the second safest class of refrigerant overall – do carry the risk of flammability. This risk is comparatively low, however, as it's near impossible for a unit using R-454B to experience

a leak significant enough to catch fire. To prepare for the rare event this does happen, many leading manufacturers have implemented sensors to shut down units experiencing a certain degree of leaking and activate a blower to dissipate collecting vapor.

Nevertheless, the low flammability of gases in this category means contractors must adopt a few A2L-specific precautions into their routine to further mitigate any risk of ignition.

One area where this rings true is transportation. Professionals can transport R-454B refrigerant canisters alongside and in the same manner as R-410A canisters, though rules from the Department of Transportation (DOT), National Fire Protection Association (NFPA), state and local building codes and more also bring additional requirements to the table. Per the International Code Council (ICC):

- Professionals must have a class B fire extinguisher and written inventory on hand when transporting anything

flammable.

- Cylinders must be positioned upright throughout the journey, keeping the relief device exposed to vapor.
- Cylinders must be arranged in a manner that prevents movement, theft or other tampering.
- Cylinders that appear empty must be handled as though full until evacuation.

Carrying both R-454B and R-410A refrigerants is necessary to continue servicing existing R-410A equipment for the duration of their lifecycles. It's crucial

contractors avoid introducing R-454B into



a machine running on R-410A and vice versa, as the differing chemical properties of these two refrigerant classes will not mix and could even lead to dangerous pressure levels.

To help avoid confusion, R-454B and R-410A cylinders assume different tank colors and embellishments. R-454B cylinders are usually gray or otherwise neutral in color, fit with a red stripe, band, or top and A2L symbol/pictogram to emphasize the risk of flammability. They also feature the printed name of the specific refrigerant and a unique left-hand thread.

Another safety consideration contractors have to budget for is a toolkit revamp, as any new equipment used to service a unit with R-454B must be rated for A2L refrigerant – including recovering machines, vacuum pumps, leak detectors and more. Manifold gauges are another tool that necessitates A2L rating, though some manufacturers are introducing gauges compatible with both R-454B and R-410A refrigerants, so keep an eye out for those.

It's Not Out With the Old

Most of the safety precautions required for dealing with R-454B refrigerant are ones contractors are already employing on a regular basis – but a refresher never hurts.

Just as they've always done when handling units with R-410 refrigerant, contractors will want to embrace the following industry best practices for units with R-454B:

- Never fill A2L R-454B recovery tanks more than 80% by volume to prevent build-up of hydrostatic pressure and possible tank rupture.
- Always adhere to Refrigerant Concentration Limits (RCL) – the maximum concentration of refrigerant that can occupy a space without risk of toxicity, asphyxiation and/or flammability. More specifically, RCL indicates the allowable refrigerant weight per cubic foot of room volume (lb./ft³). For R-454B, that limit is 18,000 PPM (0.003 lb/ft³).
- When evacuating an A2L system before charging, a triple evacuation is recommended.
- After reaching the required recovery level on a system that is charged with an A2L refrigerant, conduct a nitrogen sweep to remove any residual refrigerant vapor.
- The process of transporting R-454B refrigerant will be largely the same as that for R-410A, apart from the additional safety equipment requirements outlined above. Contractors will sign the same paperwork with suppliers and be expected to maintain safety by keeping all canisters sealed on their racks throughout transport.

- Always refer to the Safety Data Sheet that comes with the A2L unit you're working with to gauge the chemical properties, volatile temperatures, pressure limits and other safety aspects.

Preparing for What's Ahead

Many manufacturers are rolling out brand-specific training modules geared at establishing familiarity between their partners and the revitalized A2L equipment they're now working with. Contractors with a current EPA Section 608 certifications for R-410A are not required to retest for A2L refrigerants. However, the EPA does reserve the right to update the examination as they deem appropriate or necessary. A2L refrigerants are covered under Section 608, so they must be recovered, and technicians must understand the HFC phasedown and how to safely utilize R-454B.

Once the essential preparation has been checked off the list, contractors interested in learning more can turn to industry organizations such as the ESCO Institute for additional training and certifications reflective of anticipated regulatory requirements yet to come.

Contractors will also want to be ready should their customers pose questions related to how this transition will impact them. While your typical homeowner wouldn't have much in-depth knowledge regarding the technology powering their HVAC units as-is, it's possible they may read an A2L flammability warning somewhere and raise concerns about fire safety, which contractors should be prepared to assuage.

Customers with an existing system that uses R-410A may find the cost of maintaining that unit rising over time as the refrigerant becomes less available. Contractors should begin setting expectations now, at the outset of the transition, alerting customers that swapping aging units with R-410A out for new units with R-454B will help them maintain lower energy bills and a smaller carbon footprint over time.

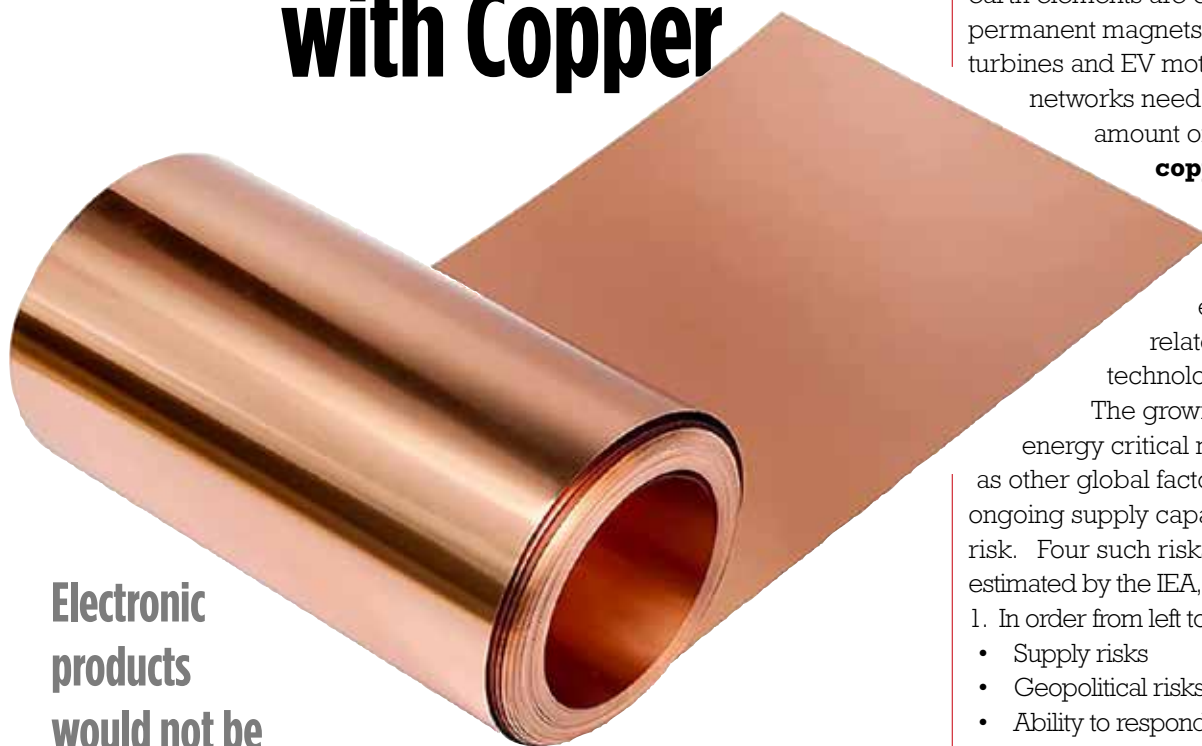


Phil Rains, Applications Engineer and Trainer at Bosch Home Comfort

Phil Rains has over 50 years of experience in the HVAC/R industry, having served as an owner/operator, application specialist, program administrator, product manager and OEM trainer. His educational background includes HVAC/R trade school, mechanical engineering, and marketing. Phil serves as Applications Engineer and Trainer for

Bosch Home Comfort [www.bosch-homecomfort.us] – a leading global provider of heating, cooling, and hot water products – where he focuses on commercial and residential water source/geothermal heat pumps and residential air source heat pumps.

Keeping Current with Copper



Electronic products would not be possible without copper.

Here we explore what you should know about this critical metal in your designs today and tomorrow.

Most circuit designers are probably not thinking about, much less worrying about, the metal copper. But as the electrification of the world continues, copper conductors used in applications from microchips, other components and circuit boards, to household, industrial and automotive wiring, and critical workhorses like batteries and electric motors, points to the need to spotlight its starring role. This article is mainly informative, but there are some actions you can take in your professional and personal life to help manage this important material.

Critical Minerals

We begin with a pair of quotes from the International Energy Agency (IEA; bold on the word copper added here by the present author).

"An energy system powered by clean energy technologies differs profoundly from one fueled by traditional hydrocarbon resources. Critical minerals such as **copper**, lithium, nickel, cobalt and rare earth elements are essential components in many of today's rapidly growing clean energy technologies – from wind turbines and electricity networks to electric vehicles."

"Lithium, nickel, cobalt, manganese and graphite are crucial to battery performance. rare earth elements are essential for permanent magnets used in wind turbines and EV motors. Electricity networks need a huge amount of aluminum and **copper**, the latter of which is the cornerstone of all electricity-related technologies."

The growing need for energy critical materials as well as other global factors means that ongoing supply capacity may face risk. Four such risks have been estimated by the IEA, as shown in Fig. 1. In order from left to right they are:

- Supply risks
- Geopolitical risks
- Ability to respond to disruptions
- Exposure to ESG and climate risks

ESG refers to Environmental, Social and Governance that may affect reporting and compliance with regulatory requirements, including the financial well-being of a company. So, it is good for electrical and electronic professionals to have some basic familiarity with this growing trend.

In the chart you can see decreasing risk from lithium to graphite, the rare earths, nickel and cobalt, down to copper at the bottom.

Where is copper found?

As geochemistry would have it, copper is widely distributed across the globe. The largest production of copper is in Chile, followed by a dozen other countries including Peru, Congo, China, US and Russia, on down to several other main producers shown in Fig. 2. To emphasize the worldwide distribution aspect, the number two producer is all the other countries not specifically named. This may be

seen as some good news, helping to reduce the risk factors listed in Fig. 1.

Side Show: Mine Tailings

Mining metals is not a clean process. Most of these operations will leave large amounts of excess material known as tailings, of which there are as many as 18,000 such dumps worldwide. These may be in the form of a slurry or sludge that is retained in ponds typically contained by earthen dams. Failure of these dams leads to uncontrolled, massive spills containing toxic metals and other substances. When this happens, millions of gallons of the tailings are released, contaminating downstream water. Even when such disasters do not occur, the tailings may dry out and release the toxins as fine particles into the air. Let us be clear by noting that dust containing metals like zinc, lead, antimony, and arsenic are unfit to breathe, especially for small children.

Regulating such tailings is difficult at best and further compounded by the fact that many sites are so old that ownership is not clearly defined. This is an example of outdated last-century industrial practice that did not properly consider or effectively deal with the long-term effects of operations and their impact on the environment, which were pushed aside as someone else's problem or simply ignored.

Possible solutions to avoiding the problems of tailings as discussed below include increased recycling of already mined and refined copper and developing nanotechnologies like those based on carbon rather than metals.

Alternatives?

It has been suggested to consider more abundant metals, including iron, aluminum, and magnesium, as possible alternatives for copper. It

does not seem likely, however, that this will become widespread or even necessary in the near future.

While the engineering, supply and cost considerations are complex, it is easy to see why copper is so often the conductor of choice. Fig. 3 is a basic list of metal conductivity. The precious metal, silver on top, like gold below copper, are pricey and often used only sparingly in applications like contacts. While the other metals are generally considered as conductors, their other properties and greater resistance losses are not desirable in most cases as a main choice, but again may fill niche functions within a component or system. Zinc is commonly alloyed with copper to make brass used in connectors,

and or with tin to make bronze, while nickel and tin are commonly found in component terminations in addition to the precious metals.

Not listed in this table of metals is another developing alternative in the realm of nanotechnology where carbon nanotubes and graphene are seeing development and growth. The conductivity of these materials is not only competitive with, but may even exceed, the conductivity of copper. Cost and availability concerns remain high at the present time, but the reader is encouraged to be aware of this upcoming technology. One of the possible environmental benefits of carbon-based technology could be the abundant availability of starting material since the element

Fig. 1.

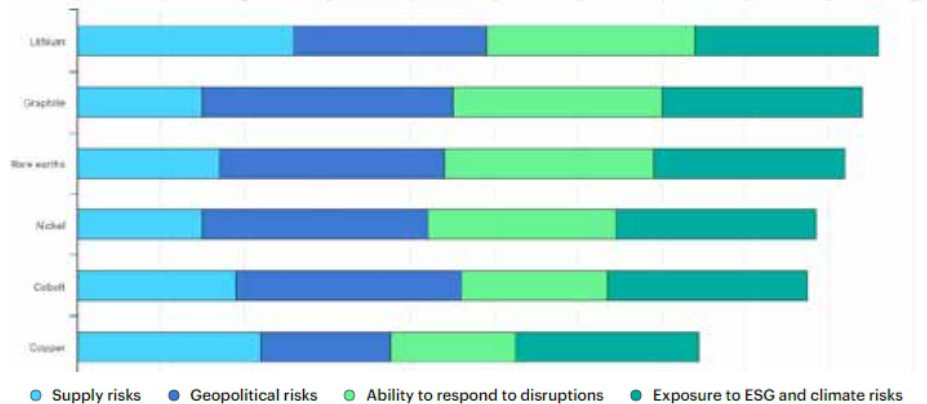
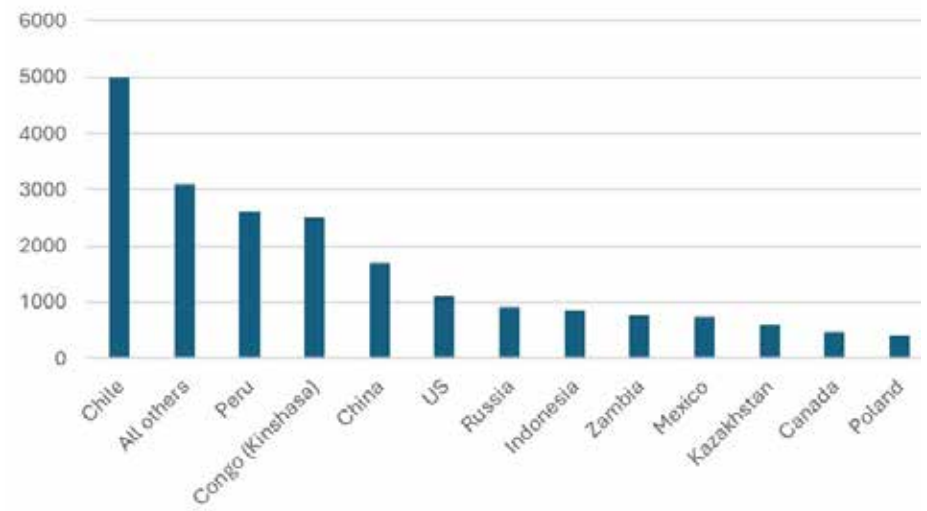


Fig. 2.



Metal	Conductivity, 20°C, S/m X10 ⁷
Silver	6.3
Copper	5.96
Gold	4.1
Aluminum	3.5
Tungsten	1.79
Zinc	1.69
Nickel	1.43
Iron	1
Platinum	0.943
Tin	0.917

Fig. 3.
Electrical conductivity of familiar metals
<https://sciencenotes.org/table-of-electrical-resistivity-and-conductivity/>

carbon is within us and all around us, and while the materials must be manufactured, unlike metals they require no mining with its resultant tailings. See Carbon-Based Components: A Solution for Sustainability?" Electronic Design, May 9, 2024.

Life Cycle Considerations

Plainly stated, combustion engines consume fuel and burn it to carbon dioxide, water, and various undesirable side products. Metals like copper to power the world with electrical energy are not consumed but used for years, then may be recovered, recycled and reused over and over. This fundamental difference is one of the drivers of broad initiatives like that of the European Union's "Circular Economy." This builds on the existing WEEE Directive (Waste Electrical and Electronic Equipment) that requires diversion of such equipment from landfills and incineration to a closed material loop.

From a more technical perspective, guidance like the series of European standards EN 50625 Collection, logistics & Treatment requirements for WEEE, and its technical specification 50625-5 specifically address copper and precious metals in electronics. Conformance requires 100% of copper, gold, silver and palladium be collected as inputs to recovery, with a minimum 90% resulting yield

for all four metals. These metals can then be returned to the stream of commerce and merged with newly produced metal, to continue new product production. Other parts of the 50625 series of standards are specific pretreatment of lamps, CRT's and flat panel displays, temperature exchange equipment containing refrigerants, and photovoltaic panels, which should be of particular interest if work on those products. (Links to the full standards cannot be provided here since the documents must be purchased from the owning organization or authorized publisher.).

Closed loop product life cycle thinking is not new to the electronics industry since regional collecting, recycling, and reuse of electronic consumer products has been practiced for several decades. The current US EPA guidance terms this "donation" rather than mandatory collection. Recycling organizations like e-stewards provide certification for recycling operators who conform to best practices and has a searchable index of global recycling companies by region. Your local solid waste authority may also offer such services, for example, drop-off locations or scheduled curbside pickup of WEEE. From a practical perspective, your copper and similar metals would most likely fit under the scrap category of Recycled Materials Association (ISRI) Scrap Specifications Circular code EM3, , Circuit boards and Shredded Circuit boards From the Processing of End-of-Life Electronics. More along these lines may be found in "Making Electronic Products More Recyclable." Electronic Design, May 10,2021.

Conclusions

That copper is a most capable electrical conductor is not news, but hopefully the insights on its origins, side effects, and environmental life cycle impacts has been interesting and useful to you. We conclude with

these take-aways.

- Copper is an important contributor to the overall circular life of electronics
- How our professional work impacts the environment deserves to be more widely understood
- Alternative conductor materials based on carbon nanotechnology are being developed.
- You can use this information in your daily life when you recycle rather than dispose of your obsolete or nonfunctional electrical and electronic equipment.

Penny for your thoughts.

Fig. 1. Clean energy transition risk score for key energy transition minerals.

Source: IEA (2024), Clean energy transition risk score for key energy transition minerals, IEA, Paris <https://www.iea.org/data-and-statistics/charts/clean-energy-transition-risk-score-for-key-energy-transition-minerals>, Creative Commons public domain License: CC BY 4.0

Fig. 2. Worldwide Copper Production.

Data from US Geological Survey Mineral Commodity Summaries, Jan. 2024. <https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-copper.pdf>

Fig. 3. Electrical conductivity of familiar metals

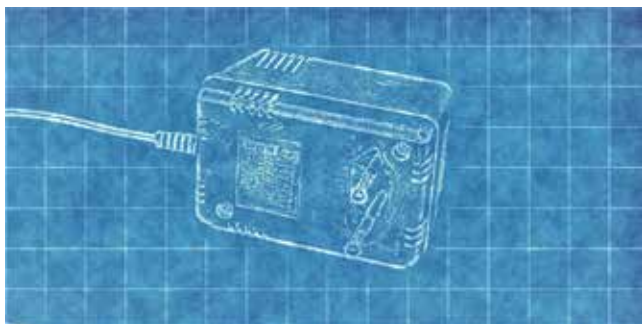
Data: <https://sciencenotes.org/table-of-electrical-resistivity-and-conductivity/>

Roger L. Franz is an advocate for using chemistry to understand how things are made and how they impact the world. Following completion of his BA and MS degrees he spent several years in biomedicine, then turned



to electronics where he has worked on new product development, quality, reliability and compliance. He received a Motorola CEO EHS award for halogen-free circuit board technology, is a Six Sigma Green Belt, and has one US patent and over 40 publications in industry journals. His goal is to continue to peacefully fight for reducing product environmental footprint, working with both industry and environmental advocacy groups. In his spare time, he enjoys the outdoors, family activities, and writing and performing songs about all angles of the world. www.linkedin.com/in/rogerlfranz RogerLFranz@gmail.com

What's Happening



DOE Appliance Standards for External Power Supplies

The U.S. Department of Energy (DOE) has recently proposed new energy conservation standards for External Power Supplies (EPSs). These proposed standards, known as Trial Standard Level 4 (TSL4), aim to tighten energy efficiency requirements across all types of EPSs.

Understanding Trial Standard Levels (TSLs)

TSLs are a tool used by the DOE to set energy conservation benchmarks. Each TSL signifies a specific level of energy efficiency, with higher numbers indicating stricter requirements. These levels are determined through comprehensive analyses that consider factors like technological feasibility, economic impact, energy-saving potential, and environmental considerations.

Efficiency Levels Explained

Each TSL corresponds to a set of Efficiency Levels (ELs) for different categories of EPSs. For example, Efficiency Level 1 (EL1) aligns with the EU Code of Conduct Tier 2 for basic and low single voltage power supplies. On the other hand, Efficiency Level 4 (EL4) represents the highest level of stringency, with only 1%-5% of products meeting the criteria.

Historical Context

The Energy Independence and Security Act (EISA) of 2007 laid the groundwork for energy conservation standards for EPSs. The most recent update was in 2014, known as Level VI standards. The proposed DOE Level VII standards are as follows:

Advocacy and Future Directions

While the DOE believes the proposed standards are the most stringent and are both technologically feasible and economically justified, some advocates argue for even higher standards. The DOE acknowledges that products meeting these proposed standards are already commercially available, thanks in part to advancements in wide bandgap technologies like silicon carbide and gallium nitride (GaN).

Additional Benefits

Higher efficiency EPSs offer more than just energy savings. They are also smaller, cooler, and more reliable, features that will become increasingly important as the industry evolves.

Further Information

For more details on the proposed EPS standards, you can visit the [regulations.gov](https://www.regulations.gov) website and refer to docket EERE-2020-BT-STD-0006.

Littelfuse Announces Grand Opening of Manufacturing Plant in Piedras Negras, Coahuila, Mexico



New facility signals growth in circuit protection across strategic Industrial markets.

Littelfuse recently held a ribbon-cutting ceremony to celebrate the opening of a new manufacturing plant in Piedras Negras, Coahuila, Mexico. This new facility strengthens the Littelfuse commitment to customer satisfaction through innovative growth in the global industrial circuit protection sector and highlights our commitment to sustainability and investment in our local communities.

"We're very pleased to announce the opening of a new location in Piedras Negras," said Peter Kim, Senior Vice President and General Manager, Industrial Business Unit, Littelfuse. "This not only allows us to further expand our manufacturing capabilities to meet the growing needs of the Industrial market, but it reinforces our commitment to being an employer of choice in the community."

The newly opened and operational 106,000-square-foot facility, which doubles the current local Littelfuse manufacturing capacity while maintaining room for additional expansion, is located close to three other company operations in the city. The Littelfuse legacy and reputation as a leader in circuit protection is evident in this facility, which has already begun the production of a wide range of electrical products for renewable energy, data center and telecommunications, commercial

construction, HVAC, and OEMs in factory automation and industrial machines.

The facility's innovative automation systems ensure precision and efficiency, allowing for a high degree of customization to meet specific client needs.

"This new location allows us to better align our services with our customers' demands in a cutting-edge and growing space," said Darrick Santa Maria, Vice President Industrial Circuit Protection, Industrial Business Unit, Littelfuse. "It was also important to us that we invested in equipment and processes that decrease our environmental impact and further our sustainability commitment."

The purpose-built facility utilizes water treatment processes resulting in zero water consumption. The smart air compressors, high-efficiency HVAC, safety relays, and use of LED lighting throughout the facility deliver energy effectively and efficiently.

The manufacturing operations team of 1,000 employees is being staffed from a combination of current talent from nearby Littelfuse locations and new hires. The facility is fully accessible, convenient to public transportation and daycare, and will bring increased opportunities for career development and community outreach and support.

CELEBRATING 75 YEARS OF AMERICAN MANUFACTURING OF CUSTOM TECHNICAL CERAMICS

As a world leader in technical ceramics manufacturing, Du-Co Ceramics Company is proud to celebrate 75 years in business. The Pennsylvania-based company with manufacturing locations in Saxonburg, PA and Monroe, NC has become a true small business success story that started from humble beginnings in a repurposed slaughterhouse in 1949.

In the over seven-decade history, Du-Co Ceramics has become a world leader of custom manufactured technical ceramic components and insulators.

This past February commemorated the company's 75th year in business. Du-Co's ongoing commitment to continuous improvement while meeting the requirements of their customers has been the foundation which the company has built on for each of those 75 years.

Get more information on Du-Co Ceramics Company's story, capabilities, and products by visiting <https://du-co.com/>

Du-Co Ceramics' origins began in 1949 when John J. Duke, President and Reldon W. Cooper, Vice President and General Manager, started the pursuit of their vision to grow their new business based on



personal commitment to integrity, reliability, quality and superior customer service. The company, currently owned and operated by the Cooper family, attributes the company's continued success to adherence to these same time-honored principles. Continuous improvement and facility investment programs form the basis upon which dedicated Du-Co personnel, comprised of experienced and skilled ceramists, aspire to continue the legacy of providing superior customer service through:

- Reliable delivery
- Meeting Quality Expectations
- Competitive Pricing

Du-Co Ceramics Company still utilizes some customized production equipment designed and built by Mr. Cooper, who recognized the importance of developing in-house maintenance and tool and die capabilities to assure adherence to production schedules to be a reliable supplier. In the 1970's Du-Co Ceramics Company added the office building, tunnel and tool & die shop to the manufacturing facility. Du-Co Ceramics continued its expansion in 2001 by adding additional space, again increasing the manufacturing area's square footage. In 2007, Du-Co Ceramics Company purchased the assets of another ceramic company which included a new manufacturing facility in Monroe, NC. With the continual success of the company, brought on by the solid leadership of the company's owners and the unwavering dedication of its employees, Du-Co added a new metalized production line in 2022. With all the expansion efforts, Du-Co Ceramics currently has two ISO 9001 certified production facilities utilizing over 250,000 square feet. Du-Co Ceramics Company looks forward to continuing to provide quality ceramics at competitive prices for the next 75 years and beyond.

15 Member States call for publication of Heat Pump Action Plan



A group of 15 EU governments called for the announced Heat Pump Action Plan to be published in a joint discussion paper published last week. The plan

was initially due in early 2024 but was unexpectedly delayed by the Commission.

For the European Heat Pump Association, publishing the Action Plan quickly is essential to providing the long-term policy clarity the heat pump sector needs.

The 15 countries also request:

- A quick ramp-up of renewable energy technologies such as heat pumps and industrial heat pumps to be integrated into district heating
 - A clear direction for the update of renewable solutions for low- and medium-temperature industrial heat applications and smart deployment of waste heat
 - Clear political signals in an upcoming framework to deliver on the decarbonisation of the heating and cooling sector
 - A revision of the EU Heating and Cooling Strategy from 2016 to bring in line with the upcoming 2040 targets
- New refrigerator runs by flexing its artificial muscles

A team of researchers from Saarland University and the Center for Mechatronics and Automation Technology (ZeMa) has developed what it claims is the world's first refrigerator that cools using artificial muscles composed of nitinol — a nickel-titanium alloy.

According to its developers, the refrigerator is a compact prototype that demonstrates the new cooling technology, which works according to the elastocaloric principle wherein heat is removed from a region via stretching wires and thus releasing them. The team explained that the shape-memory wires featuring the super-elastic nitinol — which are also called “artificial muscles” — accumulate heat within the cooling chamber and subsequently release it into the surrounding air. This process, researchers suggest, offers environmentally friendly and energy efficient cooling and heating technology when compared against conventional technologies.

Source: Saarland University and the Center for Mechatronics and Automation Technology (ZeMa)

“Our elastocaloric process enables us to achieve temperature differences of around 20 degrees Celsius without using climate-damaging refrigerants in a far more energy-efficient manner than today's conventional technologies,” the researchers added in a statement.

While engineers currently demonstrate elastocalorics within small cooling chambers, the material can also reportedly extract heat from and supply it to larger spaces. As such, the research team is also using the superelastic wires for heat transfer in heating applications.

The researchers accomplish this by harnessing the shape memory characteristics of the nitinol-based artificial muscles to transfer heat. The alloy's wires can reportedly “remember” their initial configuration

and can subsequently return to it after stretching or distorting, much like muscles flexing.

The researchers explained that this is due to the fact that nitinol features two crystal lattices — or phases — that can transform into one another deep within. Further, the wires absorb heat and then release it at such crystalline structure phase transitions.

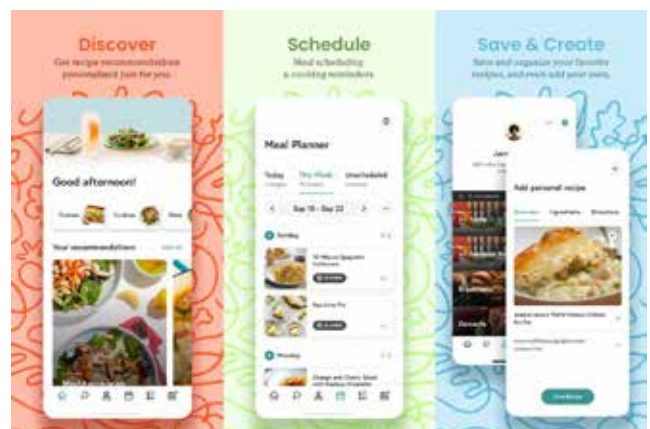
Specifically, the shape-memory material will release heat when stretched in a superelastic state, and will absorb heat when released. This effect is amplified when several wires are grouped together, with their increased surface area enabling them to absorb and release more heat, thereby intensifying the impact.

As such, the research team developed its mini-fridge featuring a patented cam drive that rotates bundles of 200 micron-thin nitinol wires around a circular cooling chamber.

The researchers added that as the wires rotate, they take turns being mechanically loaded and unloaded, absorbing heat from the circulating air within the chamber. Meanwhile, the cooled air circulates around unloaded wires and the rotating wires release heat outside the chamber when stretched.

Going forward, the team wants to leverage the potential of elastocalorics in applications including industrial cooling, electric vehicle cooling and household appliances.

For more information on this research, watch the accompanying video that appears courtesy of Saarland University and ZeMa.



Whirlpool Lays Off Entire Team for Cooking and Recipe App Yummly

Appliance giant Whirlpool has let its entire Yummly team go. According to industry sources, the company recently laid off all the employees for the recipe and cooking app and website. These sources tell the Spoon that it's unclear what the company plans to do with the property it acquired in 2017.

The news of the layoffs marks a significant de-emphasis on creating a connected cooking experience tailored around custom-designed recipes with step-by-step cooking.

"Every day, millions of consumers around the world use Whirlpool Corporation appliances to prepare meals for their families. The Yummly acquisition will allow these consumers to dramatically reduce the stress from meal planning by helping answer the age-old question, 'What's for dinner tonight?'" the company said at the time of the acquisition.

After Whirlpool acquired Yummly, it beefed up the content team and hired content creators to build a recipe catalog with cooking guidance. It also added features such as built-in food image recognition capabilities and put out a Yummly-connected thermometer (which is still available for purchase). The company announced an update with new features as recently as last fall.

The move to let the Yummly team go is indicative of appliance brands de-emphasizing apps with human-powered editorial-driven content, especially as some start to investigate how they can leverage generative AI to power new features and content. The Spoon has heard rumblings that other appliance brands are starting to build generative AI-powered content libraries and consumer-facing UI with mixed results. My guess is this trend will only continue, even as appliances begin to revisit their smart appliance strategies after lessons from the first wave of product build-out.

HVAC Industry Leader Jim Bard Dies at 87

James R. "Jim" Bard worked for the family business, Bard Manufacturing Co. in Bryan, Ohio, for more than 40 years and was an active member of the Air-Conditioning, Heating and Refrigeration Institute.

James R. "Jim" Bard of Bard Manufacturing Co., a longtime manufacturer of commercial HVAC products, died peacefully at his home on July 21 at the age of 87.

Bard was born in 1937, the son of Randolph and Naomi Bard, according to an online obituary published by the Oberlin-Turnbull Funeral Home. He graduated from Bryan High School and earned a bachelor's degree in mechanical engineering from Indiana Tech.

Bard entered the family business in 1960. He was appointed an officer of the company in 1970 and was co-



Photo courtesy of
Oberlin-Turnbull Funeral Home

chairman of the board of directors when he retired in 2003.

In 2004, Bard was presented with the Distinguished Service Award from the Air-Conditioning, Heating and Refrigeration Institute (AHRI) in recognition of, and appreciation for, his longtime dedication to the industry. The award recognized his participation in AHRI product sections and certification and policy committees, and his membership on the association's board of directors, over a period of 30-plus years, according to a statement from AHRI.

Bard was chairman of the Bryan Area Foundation from 2006 to 2008, served as president of the Bryan Rotary Club in 1978, and had been involved in leading United Way drives and Junior Achievement programs. He and his brother, Richard, were co-recipients in 2009 of the Bryan Good Citizen Award.

According to the funeral home, Bard is survived by his wife, Joan, to whom he was married for nearly 69 years; a daughter, Pamela Steel, and her husband, William; a sister, Kathy Martinez; a brother, Richard, and his wife, Mary; and five grandchildren. In addition to his parents, he was preceded in death by a daughter, Michelle Geary.

Memorial contributions can be directed to Wesley United Methodist Church or to the Bryan Area Foundation – Community Impact Project Fund.

New Sinamics G120X Drive Series Specializes in Infrastructure Pump, Fan and Compressor Applications

Siemens is introducing the new Sinamics G120X drive, a simple, seamless and easy-to-use drive, designed for use in pump, fan and compressor applications in industries such as water/wastewater, HVAC/R, irrigation/agriculture and in industrial environments. Sinamics G120X has a power range of 1–700 hp (0.75–630 kW) and can operate in a temperature range from -4 to +140° F (-20 to +60° C) with any standard motor, including synchronous reluctance motors (SRM). It has an integral DC choke which improves harmonics and EMC performance. Sinamics G120X meets all the latest and upcoming UL, NEMA and EN/IEC standards for 2019 and beyond and offers up to 100 kA short-circuit current rating (SCCR) ensuring enhanced product safety and energy efficiency.

Sinamics G120X easily integrates into existing applications and is configured for cost-optimization and resource-saving operation, which ultimately helps reduce total cost of ownership.

The compact design of the G120X saves space in the control cabinet and can also be easily integrated into MCC solutions (including plug-in buckets). Even without an additional output reactor, Sinamics G120X drives enable motor cable lengths of up to 492 ft. (150 m) with category C2 or C3 filter and up to 1476 ft. (450 m) without filter and have hardware-based SIL3-certified safety functions built-in.

"The Sinamics G120X offers outstanding "out-of-the-box" ease of use and is simple to commission and operate using its high-resolution graphical color keypad, known as IOP-2 (intelligent operator panel), as well as the optional Wi-Fi-enabled Smart Access wireless module — both optimized for pump and fan applications", states Nikunj Shah, product manager, Siemens, Digital Factory, US.

Shah continues, "Sinamics G120X drives offer an automatic restart function after power failures and the multi-pump/staging operation mode allows the user to control several pumps using just one drive. Its energy-saving mode automatically switches the motor on and off to save energy and reduce wear. G120X also has built-in energy functions which display energy consumed as well as energy saved."

The G120X has Class 3C3 coating which is suitable for harsh environments where the presence of corrosive gases such as Hydrogen Sulfide (H₂S) is present. A high C2 or C1 EMC category ensures the drive can be reliably used in any kind of industrial and public networks.

Sinamics G120X is compliant with all relevant EU and upcoming NEMA energy-saving standards and offers an operating efficiency level of over 98% (efficiency class IE2). Its comprehensive range of integrated application-specific functions for pumps and fans ensures

improved energy efficiency through amount of actual energy needed in line with the actual load which ensures the best possible performance and minimal energy losses.

Sinamics G120X is fit for digitalization and can be linked to Mindsphere by using Sinamics Connect 300 and the Mindsphere app Analyze MyDrives. This offers users the opportunity to analyze valuable operating data gathered from the drive, and enables the visualization and analysis of status information, providing users with valuable data which can be used as the basis for process optimization and maintenance strategies. Mindsphere is the cloud-based, open IoT operating system from Siemens that connects products, plants, systems and machines, and enables a user to harness the wealth of data generated by the Internet of Things (IoT) with advanced analytics.

A. O. Smith Appoints Stephen Shafer President and Chief Operating Officer

Global water technology company A. O. Smith Corporation ("the Company") (NYSE: AOS) announced the appointment of Stephen Shafer as president and chief operating officer.

In this role, Shafer will lead the company's



global business units, including operations, engineering and IT. "Steve will work with me and our team to drive enhanced performance and continued growth in sales and profitability," said Kevin Wheeler, chairman and CEO.

Shafer is an accomplished business leader with deep global experience in manufacturing and leading highly innovative businesses. He joined 3M Company in 2010 and has held several positions with increasing levels of responsibility in multiple 3M business units in both the U.S. and China. Most recently, he served as president of the Automotive and Aerospace Solutions Division for 3M Company. Prior to 3M, Steve worked for McKinsey & Company and Ford Motor Company holding various roles focusing on manufacturing, supply chain and operational improvement.

"We are excited to welcome Steve to A. O. Smith, where his strategic business acumen and extensive experience in global operations will prove invaluable as we continue to create value for our customers, employees and shareholders," said Wheeler.

"Joining A. O. Smith is a great opportunity, and I am looking forward to contributing to the continued growth and success of this iconic company. Working closely with the senior leaders in the organization to continue to improve operating performance, while maintaining a strong focus on innovation, safety and quality will be priorities for me," said Shafer.

Shafer earned his MBA from Harvard Business School and his Bachelor of Science degree in Industrial Engineering from Northwestern University. He resides in Minneapolis, MN and will be relocating to the Milwaukee area.

Building Decarbonization Meets Water Conservation

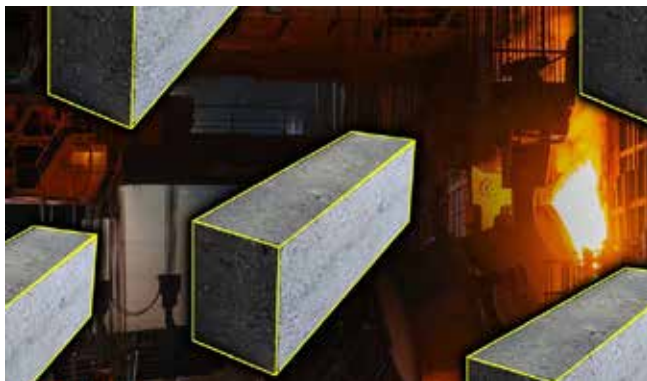
BDC analyzed water-savings data from ten thermal energy networks (TENs) across the U.S. and Canada in this new brief, which showcases their significant water conservation potential. Building Decarbonization Meets Water Conservation: The Potential of Thermal Energy Networks to Cool Buildings & Save Water reveals that replacing conventional heating and evaporative cooling systems with thermal energy networks saves millions of gallons of water each year. Eight sites reported a collective annual savings of 337 million gallons—equivalent to the average annual water use of 3,000 U.S. households.

Keeping buildings and their occupants cool is a matter of health and safety, especially as heat waves have tripled in the last 60 years. But traditional evaporative cooling systems consume vast amounts of water; one estimate from Los Angeles County suggests this infrastructure consumes 2.5 billions of gallons a year. Thermal energy networks, which recycle and recirculate heat instead of releasing it through evaporation, offer a promising solution to the challenge of thirsty buildings.

The brief calls for more standardized data collection to

help researchers, building owners, and engineers better understand and maximize water savings—especially as federal funding, state legislation, and new utility pilot projects drive the expansion of TENs and other building decarbonization strategies.

Electrified Thermal Solutions' Joule Hive™ Thermal Battery Achieves Technology Readiness Level 6, Meeting Key DOE Performance Milestone - Selected for over \$40M in Department of Energy Funding



After Cycling its Full-Scale Brick Stack up to 1,700°C for Extended Periods, Massachusetts-Based Thermal Energy Storage Company Meets Key Milestones to Qualify for Additional ARPA-E Funding

Electrified Thermal Solutions (ETS), a Boston-based pioneer of innovative thermal energy storage solutions, receives Technology-to-Market Plus Up extension funding from the U.S. Department of Energy (DOE) Advanced Research Projects Agency-Energy (ARPA-E). ETS' Joule Hive Thermal Battery (JHTB) successfully completed the final milestones required for this significant Supporting Entrepreneurial Energy Discoveries (SEED) funding by cycling its E-Brick heated circuit to a temperature of 1,700°C (3,092°F) in ambient air operating conditions. The JHTB achieved a Technology Readiness Level (TRL) 6 by blowing air across the bricks' surface, demonstrating the system can deliver the heat to industrial processes. Following a \$5M award selection from the DOE Industrial Efficiency and Decarbonization Office and a \$35M award selection from the DOE Office of Clean Energy Demonstrations, ETS expects to achieve TRL 8 in 2025 with a megawatt-scale Joule Hive Thermal Battery commercial demonstration. This will enable ETS to decarbonize the heat processes of its industrial partners in the cement, chemicals, food and beverage, and consumer goods manufacturing sectors.

While carbon emissions from power generation and transportation continue to fall, emissions from heavy industry are still increasing. Industrial heat processes are responsible for approximately 20% of

global greenhouse gas emissions. The vast majority of industrial heat demand is currently met by burning fossil fuels, particularly natural gas. ETS has developed the most cost-competitive zero-carbon alternative; the company's Joule Hive Thermal Battery (JHTB) can harness clean energy-derived electricity to generate, store, and deliver zero-carbon heat to even the hottest industrial processes.

Developed over almost a decade at MIT, ETS' JHTB provides the lowest-cost decarbonized heat by either using onsite renewable electricity or charging from the grid during off-peak hours when electricity is the least expensive. The JHTB will be the first thermal energy storage system to durably deliver up to 1,800°C (3,275°F) heat from electricity, hot enough for even the most demanding industrial applications. In demonstrating that ETS' E-Brick circuits can generate the required temperatures directly from electricity while durably and continuously cycling between low and high temperatures is a key milestone to commercialization and achieves the vision jointly set out by ETS and ARPA-E. ETS' JHTB will make zero carbon, cost-competitive, on-demand, flame-temperature industrial heat a reality for heavy industry, including steel, cement, glass and chemical companies.

"We are quickly knocking down the barriers to electrifying high-temperature heat processes for industry," said Daniel Stack, Co-founder and CEO of Electrified Thermal Solutions. "Historically, the inability of state-of-the-art metal, ceramic, or graphite heating elements to survive at the highest temperatures that heavy industry requires has been a show-stopper for the electrification of steel, cement, glass and other super-hot industrial processes. By slightly altering the composition of the age-old firebrick, we've created a heating element that can durably deliver clean heat at temperatures hot enough for any industrial process. ARPA-E support has enabled us to prove this with factory-manufactured bricks in anticipation of rapid commercialization of our thermal energy storage system."

"This milestone marks an important step in opening the door to decarbonization of industrial heat processes around the world," said Dr. Peter de Bock, Program Director at ARPA-E. "ETS achieved this breakthrough as part of its milestones from an ARPA-E SEED award in 2021, and this latest funding will support business development efforts to advance commercialization of ETS' Joule Hive Thermal Battery."

Following this successful milestone, ETS is now moving towards building a 1MW, 5MWh JHTB commercial demonstration system, which will be operational in 2025. ETS will immediately follow this with first-of-a-kind deployments at customer sites in support of its goal of delivering 2GWs of thermal power capacity by 2030. In doing so, ETS will advance towards its mission to decarbonize heavy industry with electrified heat.

Governor Hochul News Release: Governor Hochul and Minister Schreinemacher of the Netherlands Establish Partnership to Strengthen International Semiconductor Opportunities Between New York and the Netherlands



During Royal Visit by Their Majesties King Willem-Alexander and Queen Máxima of the Netherlands, Governor and Netherlands Minister Sign Memorandum of Understanding To Advance Shared Goals for the Future of Semiconductor Manufacturing

Establishes New Program To Sponsor up to Five SUNY Students' Attendance at Prestigious Eindhoven Semicon Summer School Program in the Netherlands

Governor Also Hosts NY/Netherlands Semicon Forum at NY CREATES' Albany NanoTech Complex to Convene Semiconductor Businesses, Researchers and Supply Chain Partners

Builds on Governor's Commitment to Creating a Modern, 21st Century Economy in New York State

Governor Kathy Hochul and Netherlands Minister for Foreign Trade and Development Cooperation Liesje Schreinemacher today announced a new partnership to strengthen innovation and collaboration in the semiconductor industry between the Netherlands and New York State during the royal visit by Their Majesties King Willem-Alexander and Queen Máxima of the Netherlands. The partnership, formalized in a memorandum of understanding signed today by Governor Hochul and Minister Schreinemacher recognizes the entities' shared interest in promoting sustainability within the semiconductor industry, enhancing joint workforce development opportunities, and advancing semiconductor research and development. As part of this new partnership, the Governor also announced a new state program to sponsor up to five SUNY students' attendance at the prestigious Eindhoven Semiconductor Summer School program this summer in the Netherlands.

"This partnership with our Dutch counterparts will help to take New York's chips transformation to the

next level," Governor Hochul said. "New York and the Netherlands share a belief that the countries that lead the semiconductor renaissance will chart the path forward for the rest of the world. With this MOU, we are doubling down on our commitment to putting collaboration, innovation, and sustainability front and center in our effort to build the next generation of semiconductor technology and create high-tech, good-paying jobs."

Netherlands Minister for Foreign Trade and Development Cooperation Liesje Schreinemacher said, "As leaders in semiconductor and integrated photonics development, New York State and the Netherlands are home to some of the most innovative companies, engineers, and researchers in the world. Of course we are very proud of this achievement, and, at the same time, there remains room for growth. As friends and allies, our countries can work together and pave the way for new business opportunities, greater innovation, and increased job opportunities, ultimately leading to a healthier, more prosperous and more sustainable society."

The MOU, which was signed during the New York/Netherlands Semicon Forum at NY CREATES' Albany NanoTech Complex, will allow for the exchange of best practices between New York and the Netherlands to drive innovative and sustainable solutions in semiconductor R&D and manufacturing. These might include innovative measures to bolster the semiconductor supply chain, as well as making strides to maximize power efficiency, water efficiency, and the development of new materials.

This new partnership also unlocks opportunities for academic collaboration between New York and Dutch universities, including a new New York State program to sponsor up to five SUNY students' attendance at the Eindhoven Semiconductor Summer School at the Technical University of Eindhoven in the Netherlands, 5-day intensive program for STEM Masters students led by leading Dutch academic and industrial partnerships.

The announcement follows the New York/Netherlands Semicon Forum at NY CREATES' Albany NanoTech Complex, which convened more than 100 semiconductor businesses, research and development centers, higher education institutions, policymakers, and ecosystem partners from the Netherlands and New York State to discuss how the two can cooperate to build strong, resilient, and sustainable supply chains. Sessions were held on key topics, including workforce development, environmental sustainability, and international collaboration.

"We are doubling down on our commitment to putting collaboration, innovation, and sustainability front and center in our effort to build the next generation of semiconductor technology and create high-tech, good-paying jobs."

-Governor Kathy Hochul

President of NY CREATES Dave Anderson said, "On behalf of NY CREATES, I am honored to host Their Majesties, the King and Queen of the Netherlands, today at our Albany NanoTechComplex, the largest and most advanced non-profit semiconductor R&D facility in North America to showcase New York State's growing innovation ecosystem enabled by Governor Hochul's strategic investments. Our 20-year partnership with Dutch companies ASM and ASML has been marked by incredible technological accomplishments and impactful collaborations, and I am enthusiastic about our collective journey while we continue to foster innovation and develop the next generation of semiconductor technologies together."

Empire State Development President, CEO and Commissioner Hope Knight said, "New York State is home to some of the world's top companies and most dynamic innovators from around the globe, and we are excited to further strengthen our strategic partnership with the Netherlands. Together, through this agreement, we will grow cutting edge businesses – especially in the semiconductor industry – and open the door to new ideas, research and talent that will create a world of opportunities."

Governor's Office of Semiconductor Expansion, Management, and Integration SVP & Executive Director Merideth Andreucci said, "It was an honor to participate in the New York/Netherlands Semicon Forum, and this partnership between the Netherlands and New York State will strengthen innovation and collaboration in the semiconductor industry. Today's discussions and event exemplify our commitment to knowledge sharing, learning and adopting best practices in sustainable manufacturing with our Dutch partners."

Governor Hochul's Innovation Agenda

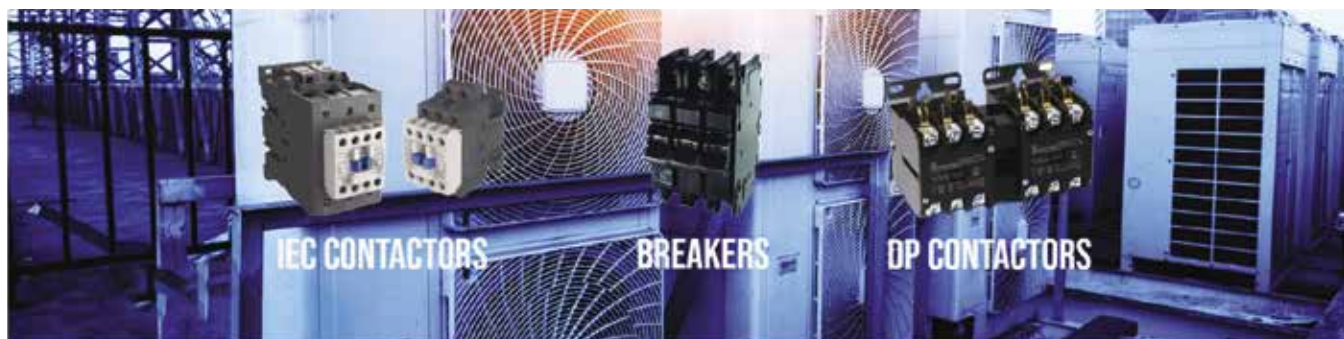
The partnership builds on Governor Hochul's commitment to driving innovation across New York State to attract major employers and create good-paying, 21st century jobs. As part of her FY25 Enacted Budget, the Governor secured a \$275 million investment in Empire AI, a consortium of seven founding institutions that will create and launch a state-of-the-art artificial intelligence computing center in Buffalo that will put New York State at the cutting-edge of AI research.

Governor Hochul also signed New York's historic

Green CHIPS legislation to drive semiconductor research, development, and manufacturing in New York State and announced a \$10 billion partnership to bring next-generation chips research to NY CREATES' Albany NanoTech Complex. By leveraging federal CHIPS and Science Act incentive opportunities with state funding, the Governor's initiatives have unlocked historic investments from the semiconductor industry, including a \$100 billion investment from Micron to build a world-class chipmaking facility and create 50,000 jobs in Central New York, as well as investments from GlobalFoundries, IBM, TTM Technologies, and other semiconductor and supply chain businesses.

In addition, the Governor has continued to advance a \$620 million Life Science Initiative to support innovation in biomedical research. And through strategic investments like the \$113.7 million Battery-NY initiative, Governor Hochul has fueled the growth of the sustainability, green technology, and energy storage economies in New York State.

The Governor's innovation agenda has catalyzed major public and private investments, transforming New York's economy and creating good-paying jobs of the future. GlobalFoundries recently announced an \$11.6 billion investment to expand its chip manufacturing campus in New York's Capital Region, creating 1,500 direct jobs and thousands of indirect jobs. In 2022, Micron announced a 20-year, \$100 billion investment to create a megafab campus in Central New York, creating 50,000 new direct and indirect jobs and unlocking hundreds of millions of dollars in community benefits. The Governor's Life Science Initiative helped to solidify New York's selection for the \$300 million Chan Zuckerberg Biohub New York, a biomedical research hub in New York City, and significant investments from Schrödinger, Inc., Deerfield Discovery and Development, and other life sciences businesses. Earlier this year, the National Science Foundation also announced a \$160 million investment in Binghamton University's New Energy New York Storage Engine to establish a hub for innovation, technology translation, and workforce development to grow the capacity of the domestic battery industry.



RAST Connector: The Future Looks Like This



In 1986, Lumberg was one of the inventors of "Raster Anschluss Steck Technik", the connector technology that goes by the acronym RAST. Yet those who assume that a 30-year 'old' technology that was originally designed for white goods, has reached the end of its life cycle, need to think again: The system is fresher than ever and continually evolves and has long established itself in other business fields - where it enjoys continuous growth. Read about the future of RAST in this article featured in Markt&Technik, which is the result of an interview between the editor, Corinna Puhlmann-Hespen, with our managing director, Ulrich Schmidt. Advancement of a Proven Interface – Direct Mating with RAST Gaining Ground

Typical RAST connectors are here to stay for white goods. But other applications also benefit increasingly from the budget-friendly direct mating technology, such as applications for the automotive industry. Therefore, a closer look at the state of technology and anticipated innovations is well worthwhile.

The history of RAST connectors is second to none in the connector industry: in cooperation with three other manufacturers, Lumberg developed these connectors and launched them to comply with the then prevalent 'household appliance standard' in 1986. "The goal at the time was to standardize the components, to guarantee the conformity of the connectors from different manufacturers, and to eliminate errors in the

customers' production processes due to mismatching connections, or to simplify the assembly when mounting the end devices and minimize faulty wiring", says Ulrich Schmidt, Managing Director Technology at Lumberg and member of the shareholder family. For almost three decades, this connector model has been the popular standard for white goods.

RAST stands for: Raster Anschluss Steck Technik. RAST 5 connectors with a 5 mm pitch are designed to cater to currents that draw up to 16 A. 2.5 mm pitch connectors, on the other hand, can relay signal and small load currents of up to 4 A. RAST connectors tend to rely on Insulation Displacement Technology which vouches for a rational and budgetfriendly production of cable harnesses in industrial quality. This explains why RAST connectors today have become the standard for a number of sensor, switch, actuator and motor control lines which can be connected directly or indirectly with the printed circuit board or the components.

The requirements for the components have clearly risen over the past years. Ulrich Schmidt explains: "We all want low-noise washing-machines these days. Quieter appliances call for a higher enclosure. A higher enclosure leads to a rise in the ambient temperature. Higher temperatures, on the other hand, mean higher-grade plastics for connectors - which results in the continuous further development of our products." So there is no standstill when it comes to this tried & tested technology. Naturally, the requirements for glow wire resistance, the ban on lead and RoHS conformity have all long impacted the connectors' development.

Currently, a further trend is emerging: "In relation to the power load, attempts are growing to replace the relatively large RAST 5 connections with RAST 2.5 - such as, for example, to make the printed circuit board for the controls of a washing-machine more compact and therefore, less expensive", says Ulrich Schmidt. "This trend generates higher-preforming connectors for greater voltages and currents which nevertheless still feature the proven characteristics of the RAST 2.5 version."

The Next Generation of Products Lumberg recently launched two new generations of RAST connectors:

The „RAST-plus-System« boasts Insulation Displacement Technology; with a V0 fire protection



class, high tracking resistance (CTI) of over 600 V and halogen-free material, it has been crafted to meet the ever-growing demands of the electronics industry. This new product family also features a second line of coding, which ups coding options. The benefits lie in protecting customers against mismatching during assembly. "Many connectors with a small number of poles that mate with a PCB, like complex control units, benefit from a second line of coding", explains Ulrich Schmidt.

Additionally, Lumberg offers a second product family: „RAST-Power plus« connectors. These 2.5 mm connectors are the company's response to customer requests for greater rated currents in limited installation spaces. Insulation Displacement Technology allows the components to mate directly with the PCB's edge. They have been crafted for rated currents of up to 6 A, and indirectly even up to 10 A. They are - 3 - equally made of future-proof material which in combination with a double line of coding, protects against mismatching.

Just like their predecessors, both product families can be processed with existing fully automatic Varicon machines. This is a major advantage for assemblers who have already invested into the respective processing equipment for their customers.

Efficient Processing

RAST connectors are available in IDT, crimp and screw clamp technology whereby insulation displacement offers the greatest advantages due to a highly efficient wiring. An extremely efficient fully-automatic machine, such as Lumberg's Varicon 7000, can handle the processing. "This efficient process is the key to clearly reducing the costs during the production as well as quality inspection costs resulting from processes integrated in the cable's manufacturing, compared to crimping, for example", details Ulrich Schmidt. "Over the past twelve months, we were able to sell eleven fully-automatic machines of the Varicon line and roughly 30 semi-automatic machines to assemblers around the world. A needs-based machine concept with short set-up times and quick processing intervals is the vital factor here", emphasizes Lumberg's managing director in charge of technology.

Other industries have also recognized the advantages of RAST connectors so that Lumberg has been recording a continuously growing demand even beyond household appliances, such as within heating technology, for lighting or LED applications. The decisive criteria for the use of RAST connectors is frequently the limited installation space. Ulrich Schmidt demonstrates this with the help of an example: "Installation space is becoming ever tighter, such as within heating technology. Especially wall-mounted gas-fired boilers integrated into kitchens where the pump, the burner, heat exchanger and electrical wiring often have to be fitted behind a single door prove that miniaturizing has progressed substantially. This explains why manufacturers are

turning to RAST direct mating options.

The strongest growth driver for RAST connectors at Lumberg, however, is the automotive industry, which the company has been dedicating itself to more strongly. The automotive and supply industry is an essential pillar for the Lumberg Group--the company's connectedness in this industry spans from Mexico to Europe and Shanghai, and is genuinely excellent. Add to this the fact that the automotive industry's demands are very similar to those of the highly competitive and price-sensitive home appliance industry, and you have an ideal complement.

Attune's Indoor Air Quality Sensor Becomes the First in North America to Achieve Environmental Claim Validation from Global Safety Science Leader, UL Solutions



Virginia company's IAQ sensor that detects and mitigates against the harmful effects of bacteria, toxins and others in real-time receives an A rating for temperature, humidity, CO2 and particle measurements.

VIENNA, Va., Dec. 6, 2022 /PRNewswire/ -- Attune (formerly known as Senseware), a leader in wireless, sensor-based monitoring systems, announced that its Indoor Air Quality (IAQ) Sensor has become the first in North America to achieve validation to UL 2905, the Environmental Claim Validation Procedure for Indoor Air Quality (IAQ) Sensor from UL Solutions.

UL Solutions is a global leader in applied safety science and its Environmental Claim Validation Procedure 2905 for Indoor Air Quality (IAQ) Sensor Performance evaluates sensors for the measurement accuracy of multiple IAQ parameters, including common pollutants such as total volatile organic compounds (TVOCs), formaldehyde, carbon dioxide and particulate matter.

Using advanced IAQ and Internet of Things (IoT) technologies, Attune's IAQ Sensor monitors and measures several environmental conditions. Of these, carbon dioxide (CO2), temperature, humidity, and particulate matter (PM) were evaluated by UL Solutions

for their accuracy. When healthy air quality levels are not and cannot be maintained, administrators can be alerted automatically, allowing them to take immediate action to mitigate potential threats. Attune's IAQ system is the only customizable solution of its kind and is designed to meet the specific needs and outcomes of any organization.

"At Attune we believe that IoT products like IAQ sensors should be built for each indoor environment's individual requirements and strive to offer unique solutions for customers that support a healthy indoor space and work towards a sustainable future. By earning the Environmental Claim Validation for our IAQ Sensor, we are able to verify through third-party testing that our sensors deliver accuracy and efficiency in the measurement of indoor pollutants and conditions in real-time," said Serene Almomen, Co-Founder and CEO of Attune.

Testing and Validation to UL 2905 ECV provides third-party confirmation of sensors' performance for use in measuring IAQ parameters. Attune's IAQ sensor is not only the first sensor in North America to receive the validation but also got an A rating for four of the claimed parameters (temperature, relative humidity, Carbon Dioxide (CO2) and particles).

"We congratulate Attune on their IAQ Indoor Air Quality Sensor for being the first in North America to receive the UL 2905 Environmental Claim Validation for their IAQ Indoor Air Quality Sensor. This accomplishment demonstrates how this product helps their customers with efforts to use data in real-time to pursue better indoor air quality conditions," said Doug Lockard, vice president and general manager in the Retail and Consumer Products Group at UL Solutions.

About Attune (Formerly Known as Senseware):

Attune is a first-of-its-kind sensor-based technology platform with 45 patents to its technology innovations. It provides real-time assurance into critical areas such as indoor air quality, energy consumption, risk of water leaks, critical equipment status, and more. Attune is the only customizable indoor air quality monitoring solution on the market. Visit: www.attuneiot.com/

Waytek Presents New Product of the Year Award to Mechanical Products for Series 87 Circuit Breakers

The award recognizes Mechanical Products for its outstanding partnership as an innovative supplier and for providing an exceptional experience to Waytek customers.

CHANHASSEN, MN, May 22, 2024 – Electrical components distributor Waytek, Inc. has presented Mechanical Products with Waytek's



Product of the Year Award for 2023 for the Series 87 Family of heavy-duty marine-rated circuit breakers.

The Product of the Year Award recognizes the supplier that has distinguished itself with an innovative product that delivers outstanding value to customers and by demonstrating a strong commitment to excellence and collaboration with Waytek. The Series 87 was selected for the award for its high quality, utility, and quick acceptance by Waytek customers.

"The Series 87 has filled an urgent market demand for marine-rated circuit breakers of high quality and availability," said Rob Iversrud, Product and Category Manager, Waytek. "Series 87 circuit breakers meet stringent marine requirements while introducing new, competitive features. We are honored to work with Mechanical Products as a valued partner who brings new solutions to our customers and increases the product range available at Waytek."

The Series 87 is a heavy-duty, switchable, high-amp circuit breaker that features a manual reset with an On-Off switch function. It is available in panel mount or surface mount options. With a wide amp range from 25A to 250A, the Series 87 meets the needs of marine applications with a main breaker protection interrupt rating at 5,000A interrupt capacity. New features include more spacing to accommodate terminal lugs, a double set of contacts, more copper and silver to better clear faults, and a circular panel cut out for ease of use.

"We are excited to receive the Product of the Year award from Waytek," said Ron Prokup, President, Mechanical Products. "Waytek shares our passion for reliable, high-quality products, and for providing an exceptional customer experience. I want to thank our employee team that was responsible for designing and building the Series 87 product line. They are the true recipients of this award."

A decisive factor in the Product of the Year Award was Mechanical Product's collaborative approach in designing its Series 87 circuit breakers to meet the specified needs of Waytek's customers. Other principal factors included on-time product delivery and consistently positive product performance feedback from customers.

Learn more about the Series 87 circuit breakers from Mechanical Products.

About Waytek

Waytek, Inc. is a customer-driven distributor of automotive wire and DC electrical components serving OEMs (original equipment manufacturers), wire harness manufacturers, and upfitters across North America. A family-owned business founded in 1970, Waytek commits to providing exceptional service to our customers, shipping more than 99.5 percent of in-stock orders the same day.* We partner with product manufacturers known for premier quality and take pride in creating a consistent sense of purpose and unity for

our employees. With a mission to provide an exceptional customer experience, we do our part so our customers can do theirs.

About Mechanical Products

As a leading manufacturer of thermal circuit protection devices, Mechanical Products develops high-quality circuit breakers for a wide variety of products and equipment. Its thermal circuit breakers protect people and equipment by sensing and preventing dangers associated with electrical overloads and overcurrents. Mechanical Products has distinguished itself through unmatched quality and unparalleled service for over 80 years.

Budnick Converting Acquires Evans EVCO



Columbia, IL - July 1, 2024 - Budnick Converting, Inc., a leading specialty tape and foam materials converter, announced as of July 1, 2024, the asset purchase of Evans EVCO, a privately held materials fabricator and distributor headquartered in Kansas City, MO. The merger brings together two companies with complementary capabilities, cultures, and commitment to customer service.

"We are excited to join forces with the exceptional team at Evans EVCO. This acquisition is an opportunity to strengthen our position in key markets, including aerospace and electronics, enhance our customer support, and create more opportunity for our combined workforce," said Christy Hornacek, Co-Owner of Budnick Converting.

"I wanted to make sure the situation was right for our loyal customers and associates. Budnick was definitely the right fit. We'll be able to offer more adhesive tape

and foam brands with expanded converting capabilities. We look forward to utilizing our combined capabilities to provide comprehensive solutions," said Steve Shockey, Owner of Evans EVCO. To ensure a smooth transition, Shockey will remain in a consulting role during the transition.

Expanded Products & Capabilities

The merger provides both Budnick Converting and Evans EVCO customers with expanded product offerings, added services, and wider geographic coverage. Customers will eventually benefit from an even more reliable supply chain.

About Budnick Converting

Budnick Converting, Inc. is a private, woman owned corporation. They specialize in engineering and converting adhesive coated tapes, foams, films, foils, and other specialty materials into production-friendly parts. Budnick's wide range of services include slitting, spooling, die-cutting, printing, laminating, waterjet, laser, and XY-axis plotting.

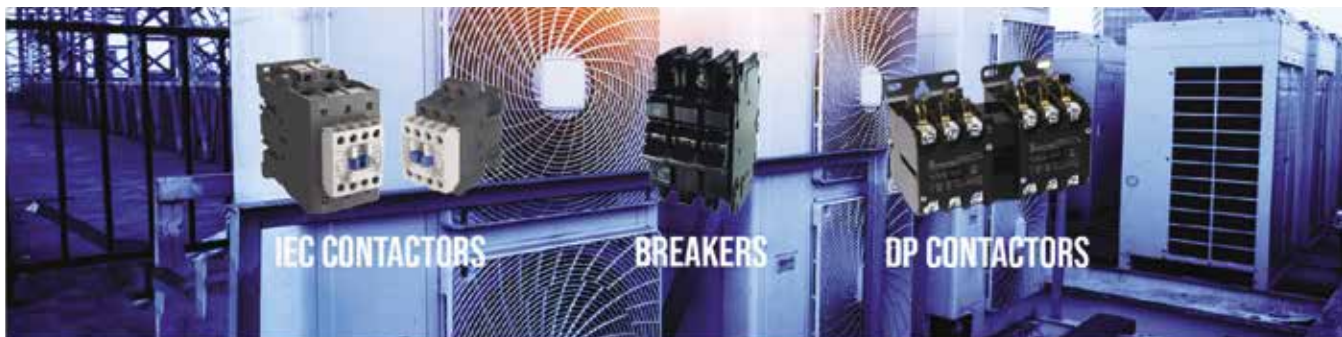
Budnick serves many industries including Appliance, Transportation, Medical, Construction, Electronics, Sign & Graphics, and General Industrial. Budnick's knowledgeable and long-tenured associates apply their expertise to help customers source the optimal material, engineer cost-efficient parts, and convert materials to exacting tolerances. Their goal is to save customers time, reduce their production costs and enhance the value of their final goods.

Susan Labadie Joins Indoor Air- Purification Pioneer CerroZone as President

New Leader Targets Growth for Next Generation of Indoor Air Quality, Providing Clean, Fresh Air for Everyone

ST. LOUIS, July 22, 2024 / PRNewswire/ -- Susan Labadie, a sales, marketing, and operations executive with decades of results in the Plumbing, HVAC, and Electrical sectors, has been named President of CerroZone.

CerroZone is pioneering the next generation of



indoor air technology, designed to improve air quality and provide fresh, clean air for everyone. CerroZone's technology improves air quality in locations that matter the most – healthcare facilities, offices, schools, laboratories, hotels, residences, and other shared indoor spaces.

CerroZone's FDA-approved Mobile, Mini, and In-Ceiling units leverage patented oxidation technology to instantly kill 99.99% of viruses, bacteria, mold, and other airborne pathogens. The devices also eliminate odors and volatile organic compounds such as ammonia and formaldehyde.

Labadie joined CerroZone in April from sister company Cerrowire, a maker of copper building wire, where she served as Vice President of Marketing, Strategy, and Innovation.

She has also held executive positions HD Supply, the Prysmian Group (a multinational wire & cable company), and professional services giant PwC.

"Susan's strategic, commercial, and managerial excellence is a perfect match for CerroZone's breakthrough technology and team of confirmed innovators," said Jared Argyle, Plumbing & Refrigeration Group of CerroZone parent company Marmon Holdings, Inc., a Berkshire Hathaway Company.

Labadie earned an MBA from Emory University and a bachelor's degree from the Georgia Institute of Technology.

"Breathing clean air shouldn't be a luxury. CerroZone has created a revolutionary technology to improve the air our customers breathe, eliminating a range of concerning pathogens present in indoor air spaces," said Labadie. "CerroZone is pioneering the next-generation of indoor air technology, designed to improve air quality and provide fresh, clean air for everyone. It's a technology that can make difference for anyone concerned with indoor air quality and safety and I'm excited to work with our team to bring it to the market."

In independent laboratory testing, CerroZone recorded a 99.99%+ reduction of COVID-19 (SARS-CoV-2) virus in a single pass, in just 1.2 seconds. Similar results were achieved with other viruses, such as RNA and MS2, as well as mold and volatile organic compounds (VOCs).

The CerroZone mobile unit is certified by the FDA as a 510(k) Class II medical device and complies with the new American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 241. CerroZone also complies with UL 2998 and has

Intertek's Zero Ozone Certification, meaning ozone levels in air leaving the unit are below the quantifiable limit of detection of 0.005 ppm.

About CerroZone LLC

Headquartered in Maryland Heights, Mo. CerroZone LLC is part of Marmon Holdings, Inc., a Berkshire Hathaway company. Marmon Holdings is a global industrial organization comprising 11 diverse business groups and more than 100 autonomous manufacturing and service businesses employing over 30,000 people. Learn more at www.cerrozone.com.

Bosch acquires residential and light commercial HVAC business from Johnson Controls and Hitachi

Home Comfort business will nearly double
Stuttgart, Germany – Bosch, the supplier of technology and services, is continuing its growth course with a strategic acquisition. For its Energy and Building Technology business sector, the Bosch Group plans to take over the global HVAC solutions business for residential and light commercial buildings from Johnson Controls. As part of this transaction, Bosch also intends to acquire 100 percent of the Johnson Controls-Hitachi Air Conditioning (JCH) joint venture, including Hitachi's 40 percent stake. The Bosch shareholders and supervisory board have approved the transaction. Binding agreements on the acquisitions were signed by the parties involved today. The acquisition is subject to approvals from the antitrust authorities. The purchase price for the acquired businesses is 8 billion dollars (7.4 billion euros). The acquisition is expected to be closed in approximately 12 months.

"As the biggest acquisition in Bosch history, this is an important milestone in the systematic implementation of our strategy for 2030. We are dynamically pushing ahead with the strong development of Bosch, and will achieve a globally leading position in the promising HVAC market with this acquisition," says Stefan Hartung, chairman of the board of management of Robert Bosch GmbH. "In taking this step, moreover, we will strengthen our presence in the U.S. and Asia and achieve a better balance among our business sectors. This is also part of our strategy. In this way, we will open up further growth opportunities and put the



company as a whole on a firmer footing.”

Together with JCH, the businesses Bosch intends to acquire generated sales revenue totaling roughly 4 billion euros in 2023, and employ some 12,000 people worldwide. The transaction includes 16 manufacturing sites and 12 engineering locations in more than 30 countries. The product portfolio covers the entire spectrum of HVAC solutions for residential and light commercial buildings, and includes well-known brands such as York and Coleman in the U.S. and Hitachi in Asia, for which Bosch will be granted a long-term license.

Christian Fischer, the deputy chairman of the board of management of Robert Bosch GmbH who is responsible for the Bosch Group's strategic growth initiatives, and thus for this planned acquisition, adds: “With this acquisition, Bosch will accelerate its growth and nearly double its sales revenue in the HVAC market to roughly 9 billion euros. Together with our future colleagues, we want to seize the huge opportunities offered by the market for the further growth of this new unit.” The company expects the global HVAC market to grow 40 percent by 2030, driven by technological progress, the fight against climate change, and new regulations. “The acquired businesses will become part of the Bosch core business – and this will benefit customers, installation partners, and associates,” Fischer adds. “We have proved several times in the past that we can successfully integrate brands, take them forward through investments, and strengthen them.”

In the words of George Oliver, CEO of Johnson Controls: “Our leading residential and light commercial business and its world-class team perfectly complement the Bosch portfolio. We are confident that under Bosch's leadership the business will continue to excel and deliver innovative products and service to its customers. We look forward to seeing their continued success.”

Jun Abe, executive officer and executive vice president at Hitachi, and executive officer and general manager of the Hitachi Connective Industries division, says: “The new partnership with Bosch to establish a global air-conditioning business is an important step. The market is dynamic, and is flourishing. I firmly believe that a global supplier such as Bosch, with its strong European presence and many years of experience in the heating business, is the optimum partner for further expanding the global air-conditioning business of the longstanding Hitachi brand.”



Thin Film Connectors — Reliable, Flexible, & Compact

A new line of electrical terminals for attaching wires to thin films typically used in flexible electronics, wearables, TFTs, OLEDs and other devices

has been introduced by ETCO Incorporated of Bradenton, FL.

ETCO TFC Thin Film Connectors are designed to reliably connect 18-22 AWG wire to aluminum- and copper-foil or film laminates from .010”-.025” thick, depending upon the substrate. Well suited for miniaturized applications, these connectors securely embed into the substrate with lances and incorporate a highly reliable F-crimp for the wire connection.

Supplied in strip form on reels, ETCO TFC Thin Film Connectors can be made from brass and tinned-brass in a wide range of custom sizes and thicknesses to precisely match OEM requirements. These connectors have been tested to maintain their integrity under various environmental conditions such as temperature changes, high humidity, and mechanical stresses.

ETCO TFC Thin Film Connectors are priced according to configuration and quantity. Price quotations and samples are available upon request.

Greenfield's Parker Hannifin Receives Governor's Award of Excellence



Greenfield is the only Weakley County recipient of award in past five years

GROUP-Group shot of all the company employers, employees and VIP attendees standing in front of Parker Hannifin in Greenfield holding their plaque of excellence.

Parker Hannifin in Greenfield was one of three companies in the state of Tennessee to receive the Governor's Award of Excellence for Workplace Safety and Health on Tuesday, June 9.

David Blessman (VPP Manager of TOSHA) and Garrett Rea (TOSHA Assistant Administrator) presented the award to employers and employees which recognizes Tennessee employers and employees meeting the minimum number of hours with no serious workplace injuries causing an employee to miss a day of work or that would restrict their normal job activities. The number of hours varies based on the size of the company.

Employees at Parker Hannifin worked over 500,000 hours without losing time or restricting their workday.

According to the Tennessee Department of Labor, Parker Hannifin in Greenfield is the only recipient of this award in Weakley County in the last five years.

TOSHA presents approximately 16 Governor's

Awards to Tennessee manufacturing and construction companies per year.

"You're making sure that you come in and go home the same way. And it's just not one person. It's not one safety director or one corporate safety director. It's each and every one of you. You should be proud of yourself and the efforts you've made in taking care of each other. What an honor. This right here is a team effort.," Blessman stated.

The company could have gone to Nashville to pick up the award, however Barry Lassiter, Value Stream Manager for Parker Hannifin asked them to bring it to Greenfield.

"You guys are the ones that earned it. We appreciate your efforts. We appreciate you looking out for each other each and every day," Lassiter said.

"It's really important to take care of each other and keep a safe working environment. It is a bog award with only three in the West Tennessee region awarded this year so you should be proud of yourselves," Senator John Stevens said.

"I want to thank each and every one of you for doing the great job of representing Greenfield in the way you do. We appreciate you so much. I know we don't express it every day, but we do appreciate every one of y'all and we appreciate this great honor that you have bestowed for Parker Hannifin," Greenfield Mayor Cindy McAdams said.

VIP Guests attending Parker Hannifin to help them celebrate included the following:

Brett Huls (General Manager, Parker Sporlan Division); Frank Wilson (Business Unit Manager, Parker Sporlan Division); Forrest Beasley (Divisional Human Resource Manager, Parker Sporlan Division); Tim Schweizer (Divisional EHS Manager, Parker Sporlan Division); Mayor Cindy McAdams; Senator John Stevens; Representative Tandy Darby; Senator Paul Bailey (Chairman: Senate Commerce & Labor Committee); Brandy Lassiter (Research Analyst: Senate Commerce & Labor Committee); Monte Belew (Senior Advisor for Congressman David Kustoff); Mike & Nancy Biggs (Mike was former Mayor and Greenfield Board Member); Janna Hellums (Northwest TN Regional Director, Department of Economic & Community Development); Tessa Kyle (Northwest TN Business Development Consultant, Department of Economic & Community Development); Justin Crice (CEO, Weakley County Chamber & Joint Economic Development Corporation); Barbara Virgin (Executive Director: Weakley County Chamber of Commerce); Angie Lassiter (Administrative Assistant, Weakley County Chamber & Economic Development Board).

The plaque of excellence will be displayed inside the company. For a slideshow of photos from the event please go to dresdenenterprise.com or martinpost.news. For video clips of the event please see our Facebook pages.



Renewaire Names David Rice VP of Sales and Marketing

VP brings a wealth of national technical sales leadership and project engineer experience.

WAUNAKEE, WI – RenewAire®, a Waunakee, WI-based manufacturer of HVAC and indoor air

quality (IAQ) products, has named David Rice as its Vice President of Sales & Marketing. Rice brings more than 37 years of diverse work experience that includes product development/marketing as well as consulting engineering for industry-leading mechanical and electrical companies. Rice is responsible for leading the ongoing development and implementation of RenewAire's energy recovery ventilator (ERV) and dedicated outdoor air systems (DOAS) sales channels and marketing strategies. "David is an outstanding sales executive and a talented project engineer, which will help RenewAire and its channel partners continue growing and expanding market share," said Scott Forest, President, RenewAire.

Much of Rice's career was spent at Eaton Corp. divisions. He served the Eaton Bussmann Division, Ellisville, MO, the industry leader in circuit protection in various sales, marketing and product management positions including Senior Product Manager and earlier as Business Development Manager. He was also VP of Marketing and Product Development for electrical accessories manufacturer, Eaton B-Line, Highland, IL. Rice has also held COO positions at high power battery test and formation equipment manufacturer, Bitrode Corp, St. Louis; and lighting fixture manufacturer, Baero North America, St. Louis. Rice began his career at consulting engineering firm, R. H. George & Associates and later joined CHP & Associates, Houston, where he was project engineer on a variety of performing arts centers, hospitals, education buildings and other commercial projects.

Rice holds a BS degree from the University of Houston; and was a Charles Knight Scholar recipient while receiving his MBA at Washington University, St. Louis. His Rice Ventures LLC, St. Louis, offered business consulting services especially in the electrical field where he's a recognized expert consultant in National Electric Code (NEC) issues and compliance.

For more information, please email: marketing@renewaire.com or call 800-627-4499.

SB5000 Industrial Shock Block® GFCI / SPGFCI / EGFPD Series - Littelfuse SB5000 Industrial Shock Block® Provides Maximum Personnel Protection



Special-Purpose Ground-Fault Circuit Interrupter (SPGFCI), Class C and Class D

The Industrial Shock Block® SB5000 series is a personnel protection device designed to meet the requirements for special-purpose GFCIs defined by UL 943C. This standard outlines GFCI classes specifically designed for use in industrial facilities. Class C GFCIs are intended to be used on three-phase systems where the line-to-line voltage is 480 V or less with a trip level of 20 mA, while Class D GFCIs are intended to be used on 600 V systems. The SB5000 includes DFT harmonic filtering, an automatic self-test feature, and is compliant to the UL 1998 Software in Programmable Components standard.

Ground-Fault Circuit Interrupter (GFCI), Class A

The SB5000 is available as a 208 or 240 V Class A GFCI, allowing commercial kitchens, vehicle service centers, and other non-dwelling applications to meet NEC 210.8(B) for their three-phase loads up to 100 A.

Equipment Ground-Fault Protective Device (EGFPD)

The SB5000 is also available with adjustable protection settings as an EGFPD. The EGFPD models can be set to trip at 6 mA or from 10–100 mA in increments of 10 mA. This offers more flexibility since GFCI and SPGFCI devices are not permitted to have an adjustable trip level.

Ratings and Models

The SB5000 is available for three-phase voltages from 208 to 600 V with a maximum full load current up to 100 A. The power system can be either solidly or high-resistance grounded, and the load must be single-phase or three-phase as long as the load does not require a neutral. The standard enclosure is IP 69K/NEMA 4X and outdoor rated, suitable for all industrial environments including high temperature washdown used in food production applications. The 32 and 60A models are also available in a hygienic stainless steel enclosure, with a 10 degree sloped top and FDA compliant silicone gasket, designed to facilitate sanitation in food processing facilities and the like.

Grounding Monitor / Interrupter (GMI)

The SB5000 also monitors the equipment grounding connection between the Shock Block and load. This is a required feature for Class C and D GFCI devices and is recommended for Class A GFCI and EGFPD devices. If the ground-return path is broken, the SB5000 will trip and provide an alarm by changing the state of the alarm contacts. This monitoring circuit requires an extra (pilot) wire between the SB5000 and the load. At the load, the pilot wire is connected to a termination device. The other end of the termination device is connected to the equipment ground (typically the enclosure).

CHPF: A Global Forum on Heat Pumps Presented by the China Heat Pump Alliance

China Heat Pump Forum

August 6-8, 2024

Shanghai Fuyue Hotel

Songjiang District, Shanghai, China



The China Heat Pump Forum and the China Heat Pump Industry Annual Conference will take place from August 6th to 8th at the Shanghai Fuyue Hotel. Widely recognized as the foremost event for discourse on the future of heat pumps, the CHPF is not only for China but for the whole world.

The CHPF draws more than 1500 participants annually from China, Europe, the United States, Japan and South Korea as well as other countries.

Delegates represent leading heat pump producers as well as suppliers of essential parts and components, along with hundreds of engineers and professionals who seek to keep up-to-date with the myriad changes in the heat pump industry. For hands-on experiences of the new technologies, an ample number of heat pump technologies and components will be on display at dozens of booths of the floor exhibit.

The conference schedule is as follows:

August 6: All-day registration

August 6, Afternoon: Board Meeting for the CHPA

August 6, Evening: Welcome dinner

August 7: Full-day meeting and banquets

August 8: Full-day meeting and departure

This annual event encourages team spirit and networking through a friendly soccer game, enhancing communication among attendees. The dinner events offer a relaxed environment for socializing and entertainment, including activities such as lotteries and performances. Each participant receives a special souvenir, adding a personal touch to the forum.

For more information or to register for this event, please contact tina.lee@chpa.org.cn directly. Registration is available up to August 6.

Automated Logic Adds Two New Controllers to the OptiFlex™ Family

Automated Logic is proud to announce the expansion of its OptiFlex controller line for the WebCTRL® building automation system.

Two new controllers join the OptiFlex family, including the OptiFlex 022 (OF022-E2) zone controller and the OptiFlex compact segment router (OFCSR-E2). These controllers feature dual IP ports for convenient daisy-chain deployment and a compact footprint for more flexible system design. Automated Logic, a leading provider of innovative building-management solutions, is a part of Carrier Global Corporation (NYSE: CARR), the leading global provider of healthy, safe, sustainable, and intelligent building and cold chain solutions.

The OptiFlex 022 (OF022-E2) zone controller is engineered to deliver unparalleled efficiency and reliability for modern building environments. Featuring dual IP ports for convenient daisy-chain deployment, the OF022-E2 supports two universal inputs and two analog outputs, ensuring versatile control options for a variety of applications. Its smaller form factor not only simplifies installation but also optimizes space, making it an ideal solution for areas requiring dependable and precise environmental control.

Complementing the OptiFlex 022, the OptiFlex compact segment router (OFCSR-E2) is designed to facilitate seamless migration from traditional serial network segments to fast and performant IP backbones. The OFCSR-E2 offers robust routing capabilities between BACnet®/IP, BACnet Ethernet, BACnet/ARCnet, and BACnet MS/TP networks, with native support for IPv4. It is equipped with three physical communication ports: two 10/100 Mbps BACnet IP/Ethernet ports and a high-speed EIA-485 port that can be configured for BACnet/ARCnet or BACnet MS/TP. Additionally, the device features a USB port for local access.

"At Automated Logic, we are committed to pushing the boundaries of what's possible in building automation to create more intelligent, connected, and efficient buildings," said Axel Reichert, President, Automated Logic. "The introduction of the OptiFlex 022 zone controller and the OptiFlex compact segment router is a testament to our dedication to innovation and our customers' needs.



These solutions not only enhance building performance and network reliability but also offer a path forward for legacy systems to embrace the benefits of IP-based communication."

The OptiFlex 022 zone controller and the OptiFlex compact segment router are now available for order through Automated Logic's global network of dealers. For more information about Automated Logic and its new offerings, please visit <https://www.automatedlogic.com>.

About Automated Logic Corporation

Automated Logic Corporation provides innovative building management solutions that maximize energy efficiency and sustainable building operation while ensuring comfort. Its intuitive products control and monitor building functions such as heating, air conditioning and lighting for commercial office, education, health care, government and data center markets through a global network of independent dealers and North American branch offices. Automated Logic is a part of Carrier Global Corporation, global leader in intelligent climate and energy solutions that matter for people and our planet for generations to come. For more information, visit www.automatedlogic.com or follow @AutomatedLogic on LinkedIn.

Lorin Highlights Black and Bronze Anodized Aluminum Finishes

Lorin Industries, Inc. highlights its range of architectural black and bronze anodized aluminum finishes.



These captivating finishes offer architects and designers an array of options to elevate their projects to new heights of elegance and sophistication.

Lorin's black anodized aluminum finishes include ColorIn® BlackMatt, BlackBrite®, Black Satin, and Black Stainless. Lorin's high-quality anodized aluminum black finishes go beyond darkness with an industry leading, deep, rich black color that is both attractive and functional. Whether you prefer a matte, satin, or bright finish, Lorin has the perfect solution for projects that warrant the black look. UV stable anodized ColorIn Black by Lorin is more resistant to fading than black colors made through other finishing or coating processes, making it a popular choice for architectural applications where a long-lasting, low-maintenance finish is desired.

Lorin's ColorIn® Bronze range of anodized aluminum finishes include Subtle Light Bronze, Light Bronze, Medium Bronze, Dark Bronze, and LA Extra Dark Bronze. All of these finishes are UV stable and have been developed for exterior applications where UV fade resistance is critical to the designer. Lorin's high-quality anodized aluminum bronze finishes offer a deep, rich color that is both elegant and sophisticated.

Lorin's black and bronze anodized aluminum finishes offer architects and designers an unparalleled combination of beauty, durability, and performance.



ASGE

AMERICAN SOCIETY OF GAS ENGINEERS

ASGE is a society that promotes technical education in the subject of gas-fired fuel, components, and appliances. Our key objectives are advancing the theory and practices of gas engineering; promoting the safe, efficient, and ecologically compatible utilization of gas; and the standardization of terminology, techniques, and laboratory testing methods. We encourage research and innovation in the gas industry and provide forums and media through which experiences and information may be shared and discussed for the betterment of the industry.

ASGE was formed in 1954 by engineers who agreed there was a need for a gas engineers' association. The Society was first formed with localized chapters that were located across the United States. The chapters held regional meetings and technical training classes. The national model was adopted in 2005, and it brought all the regional chapters together under one membership and operating society.

Our membership program offers the opportunity to share in ASGE's educational programs and constructive activities. Our annual Technical Conference is our flagship event where we explore and advance gas industry interests with fellow professionals. The two-day event is held in Las Vegas the first week of June each year. Technical presentations are given from gas Industry professionals and consultants on the subjects of gas burner/appliance innovation, safety, and regulations.



Presentation participation during the National Tech Conference
In Las Vegas, NV on June 4th, 2024.

ASGE continued...

Annually, the Certified Gas Engineer Exam is administered to individuals who meet the requirements to participate in the CGE program. The Certified Gas Engineer Exam (CGE) is what distinguishes the Society from other associations. By offering a certification program, the Society sets the benchmark for engineers in the gas industry. The exam tests on gaseous fuel basics, properties, supply, handling, safety, operating characteristics, and standards. Since the Exam's inception, ASGE has accredited over 340 CGEs within our membership and the gas industry.

At the 2024 Technical Conference, ASGE unveiled the new 3rd edition ASGE Certified Gas Engineer Handbook. The Society worked with industry professionals and spent two years going through the previous edition to remove redundancy and update to modern terminology, subjects, and values. To purchase the Handbook you must be a member and in good standing; visit <https://asge-national.org/cge-program/cge-handbook>.

In addition to the Technical Conference and the Certified Gas Engineer program, ASGE is very involved in regulatory committees and regulations. ASGE promotes the need for and the proper balance of fossil fuels as an energy source as well as the safe, reliable, and efficient operation of gas appliances and components. Many members sit on safety standard committees and also other association committees who lobby for the viable and correct future of gas. ASGE has signed onto letters that comment on regulations that have been created by federal departments like the DOE and EPA.

For more information on the Society, we have several methods of contact. We also have quarterly newsletters available by subscription. We look forward to hearing from you!

Website: asge-national.org

email: asgecg@aol.com

Address: [P.O. Box 311069 Independence, OH 44131](mailto:asgecg@aol.com)

Please consider joining us at our Technical Conference on June 1st—3rd, 2025!



Newly minted ASGE Certified Gas Engineer Handbook (3rd Edition)



Example Seal of the Certified Gas Engineer

Housing Shortage and New Rules Drive Demand for Water Heater Fabrication



Demand for water heaters is hot and will continue to get hotter into the next decade. Manufacturers will feel the pressure to keep pace with demand.

Estimates predict the global water heater market will expand from its current mark of \$30.49 billion to \$40.1 billion in 2030. With a Compound Annual Growth Rate (CAGR) of 4.7%.

The numbers for the U.S. market reflect a similar anticipated demand trend. In 2023, water heater sales tallied at \$3.45 billion. That figure is expected to increase to just over \$5 billion by the end of the decade with a CAGR at approximated 6.7%.

Factors driving the market

Several factors drive the expected rising tide for the appliance. At the top of the list is the existence of a significant housing shortage in the U.S. at the close of 2023. A February 2024 market analysis showed a 7.2-million-unit gap between single-family housing construction starts and single-family formations, with household growth outpacing single-family home permits in a substantial majority of U.S. metro areas.

Builders are hard at work to keep up with the need. Approximately, 947,000 single-family homes and 472,700 multi-family homes were started in 2023. While construction numbers fell percentage points under the previous year, it still translates as a need for more than 1.4 million new water heaters as those homes are completed.

Another component of the upward demand slope is regulatory intervention. In Europe, governments are incentivizing businesses and individuals to move toward energy efficient and consumer cost-saving water heaters. The U.S. Department of Energy (DOE) is currently proposing regulations that would require electric water heaters to begin using heat pump technology instead of electric resistance. Under the same proposal – set to take effect in 2029 – gas-fired water heaters would be required to use condensing technology. Updated regulations will call for new units.

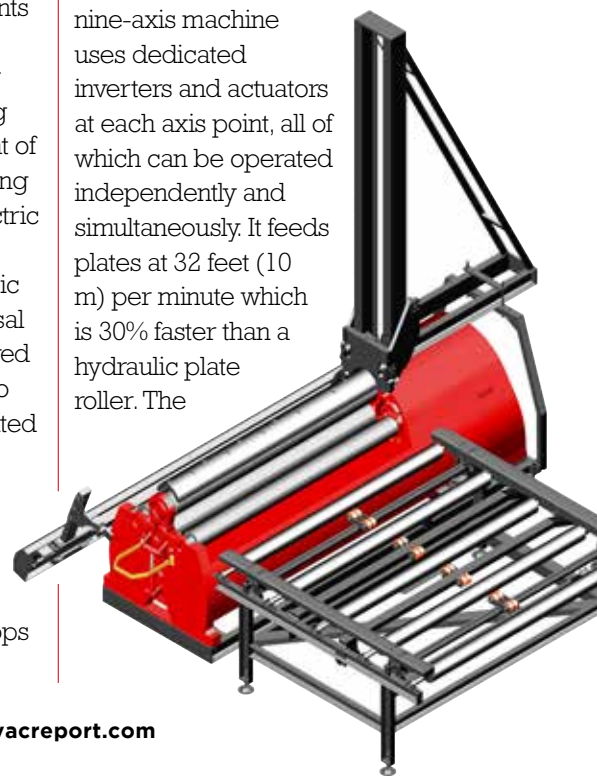
The uptick in demand means water heater manufacturers along with companies that supply the equipment to build them need to prepare now. For fabrication shops specifically, plate rolling machines

will play a huge roll in forming flat steel sheets into new cylindrical 40- to 100-gallon tanks required for traditional water heater units.

Rising on the tide with machines designed to roll

Plate rolling machine manufacturer Davi has 58 years of expertise and a long history of supplying rolling equipment, automation and solutions to water heater manufacturers. Its MCA 4-roll plate rolling machine is the result of decades of research, development and refinement that make it uniquely capable of rolling the 0.06" – 0.08" (1.5 – 2 mm) steel plates used for water heater shells. The MCA 4-roll machine maintains perfect control over plate position by clamping it with a bottom roll, and Davi's patented Servo-Tronic parallel control system always keeps machine rolls in perfect parallel alignment. The machine is also fully CNC control enabled for automated production with limited operator input required during the bending process.

In addition, Davi launched the e-Power all-electric plate rolling machine, which is a game-changer for OEMs charged with meeting the increased water heater demand. The nine-axis machine uses dedicated inverters and actuators at each axis point, all of which can be operated independently and simultaneously. It feeds plates at 32 feet (10 m) per minute which is 30% faster than a hydraulic plate roller. The



e-POWER system also incorporates fewer components and is not plagued by leaking hydraulic seals, clogged lines and the expansion of hoses and fluid due to fluctuations in pressure and temperature.

Beating the skills gap with CNC and automation

While addressing the housing shortage means increased opportunity, manufacturers still face another ongoing labor shortage. In a 2021 study by Deloitte and The Manufacturing Institute, there could still be some 2 million unfulfilled manufacturing jobs by the end of the decade. The cost to the industry of those missing skilled workers could potentially touch \$1 trillion by 2030.

Advanced CNC plate rolling machines, along with automation, will give water heater OEMs the tools necessary to meet demand while remaining profitable. The technology engineered into Davi's plate rolls gives manufacturers the precision required for cost-efficient, waste-free production. Automated machine tools, accessories to handle and manipulate the plate and a comprehensive control system to manage the entire process are essential to efficient production. The MCA 4-roll plate rolling machine with full automation is one example of an apex process that will meet the demands of a burgeoning sector despite the continuing labor crunch.

Another example, the company's iRoll eXtreme is an Artificial Intelligence (AI) driven, advanced control system that provides a smartphone experience with ergonomic controls and a high-resolution screen with live 3D interface. The control uses AI to fine tune programs, allows real-time simulation and provides Industry 4.0 and 5.0 smart connectivity and machine data acquisition. The use of such a sophisticated technology can offset the lack of skilled operators.

Davi has also integrated advanced diagnostic systems into its machines that constantly monitor status and anticipate faults and malfunctions. As a result, shops can proactively step in to prevent production disruptions and increase uptime.

With housing shortages generating new construction and regulatory changes prompting new designs, all indications point to a boom in demand for new water heaters throughout the world. Only manufacturers and fabrication shops equipped with the most advanced and efficient rolling machines will be prepared to deliver on the market's need.

Andrea Farabegoli, Marketing Manager at Davi

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Vitrek Cable & Connector Test System Facilitates Multi-Point High Voltage/Current Testing

Hipot testing is critical in assuring compliance with a host of electrical safety standards and in confirming the assembled product is free from electrical or mechanical defects. Hipot testers are used to measure leakage current and insulation resistance between all components and connections, confirm solid ground connections and test ground bonds. All of these tests require the sequential application of precise and controlled high voltages or currents between pairs of elements then accurately measuring and recording the results. Products like the Vitrek 95x and V7x Series are excellent examples of the industry's best electrical safety testers.

Many hipot tests require making multiple measurements. For example, a three-conductor power cord connected to an electronic device would require a voltage withstand test between the conductors as well as a ground bond test between the ground wire and the chassis.

A connector assembly with multiple pins would require a unique test for each pair of contacts as well as between each contact and adjacent wires and then the connector body. A simple four-conductor cable might require 20 separate tests:

1. Continuity on each conductor - 2 or 4 conductors
2. Insulation resistance between each conductor and ground or shell - 4 more tests
3. Insulation resistance from each conductor to all the other conductor - 12 additional tests

For a 24-conductor cable, the total number of individual tests could be as high as 578.

Doing this manually is not only labor intensive, it is also highly susceptible to errors:

- Were all of the combinations tested?
- Were some inadvertently duplicated?
- Have all the test conditions been implemented?
- Did the operator properly record the data?

In many cases, a programmable, multi-point switching system is an essential tool to quickly and accurately implement the entire series of electrical safety tests. Using a fixture to quickly connect the entire assembly, a multi-point switching unit serves as an interface with the hipot tester and automatically sequences the testing through all the combinations. As "simple" as this sounds, a great deal of engineering and innovation goes into these devices.

Cable and Connector Test System Components

To conduct the sheer number of tests that are often necessary in a safe and accurate way, the recommended multi-point test system would include the following:

- A Vitrek V7x Series or 95x Series Hipot Tester (a white paper titled "Fundamentals of Electrical Safety Testing" provides details of the important features and functions of the Vitrek hipot tester products, visit www.Vitrek.com for details.)
- A Vitrek 964i programmable high voltage switching system
- QT Enterprise Software for

controlling the test sequences (optional) (an overview of the features of QT enterprise software is provided at the end of this white paper.)

Introduction to the Vitrek 964i High Voltage Switching System



Figure 1. Open view of the Vitrek 964i highlights the unit's modular construction.

Whether it's an 8-pin connector, a 64-conductor cable or an entire tray of SMD capacitors, the 964i has the capability to automatically route test points to the tester without manual intervention. With voltage switching capability up to 15,000 volts or current switching as high as 70 amperes, the 964i Automated Switching System (Figure 1) routes test signals for whatever is connected to it. For example, the 964i can be utilized in applications where users need to:

- Perform hipot/continuity/ground bond tests at various points, etc.
- Apply high voltage or current to multiple points.
- Measure circuit L/C/R at various points, etc.
- Measure or apply other signals at various points (500 Hz maximum frequency,) etc.

Features of the Vitrek 964i

A valuable benefit of the Vitrek 964i is its unique ability to provide a number of different tests, thanks to its smodular design:

- **COMPLETE FLEXIBILITY** —

Combinations of relay cards, terminals and wiring can be customized. Up to 64 relays and 66 terminals can be installed in a single chassis.

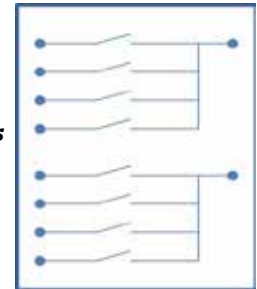
- **FRONT PANEL INPUT CONNECTIONS** — The front panel terminals are designed to allow direct connection to the output terminals of a Vitrek Hipot Safety Analyzer.
- **EASY DEBUGGING WHEN PROGRAMMING** — The presently commanded relay states are available on the front panel display, making debugging a safety test procedure easy. The user is also able to manually control the relays.
- **RELIABLE HIGH-SPEED OPERATION** — Relay states can be changed in as little as 5ms; the 964i automatically provides all of the required timing.
- **AUTOMATIC MAINTENANCE ALERTS** — Accumulates counts of relay operations for each relay on a given bank and warns the user if any relay is approaching (or beyond) its life expectancy.
- **HIGH VOLTAGE AND**

CURRENT CAPABILITY — Relay cards up to 15kV are available. Relay cards up to 70Arms are available. Both high voltage and high current relay cards can be in the same 964i.

- **DIRECT CONTROL BY VITREK HIPOT TESTER** — Can be controlled directly by a Vitrek 95x or V7x series safety tester.
- **QT ENTERPRISE SOFTWARE** — available for the PC for total system control; 95x, V7X or V series Hipot tester and up to 16 964i switching systems.
- **CHOICE OF INTERFACES** — The standard 964i comes with RS232 and VACL interfaces, the user can add an optional GPIB interface.

Each 964i is custom configured to user requirements utilizing a selection of relay cards (Figure 2) that are installed in any of eight banks in the chassis. The operation of each relay is individually controlled via commands from the tester or directly programmed into the 964i. Unlike typical cable testers which are restricted to a fixed pattern, test points can also be

Figure 3.
A special multiplexer card (HC-4) is designed to facilitate AC ground bond tests.



connected to other equipment such as an impedance (LCR) meter or digital multi-meter (DMM).

The 964i also has a full published command set so it can be programmed for use with other testers if it is needed for a different application.

Two versions of the multiplexer (MUX) cards shown in Figure 2 are available based on the specific requirements of the device-under-test (DUT). The low-voltage LV series cards can handle medium currents at voltages up to 3KVdc or 2KVrms. The high-voltage HV series cards are designed to handle low currents at voltages up to 7, 10 or 15kVdc or 5, 7 or 10KVrms.

One additional MUX card - the HC-4 cards are designed to multiplex Ground Bond tests. The HC-4 is a dual 4:1 multiplexing card; one set of 4 relays carries current up to 40Arms and the other handles voltage sense. Figure 3 shows the configuration.magnetic and thermal factors.

964i Configuration and Accessories

The 964i is easily configured to a wide range of specific test and measurement requirements.

- Select from 4 different voltage ratings - 3KV, 7KV, 10KV and 15KV.
- Determine the number of and type of cards needed based on the number of test pairs. For each card, define if it will be used as the + (HV bus) or - (return bus).

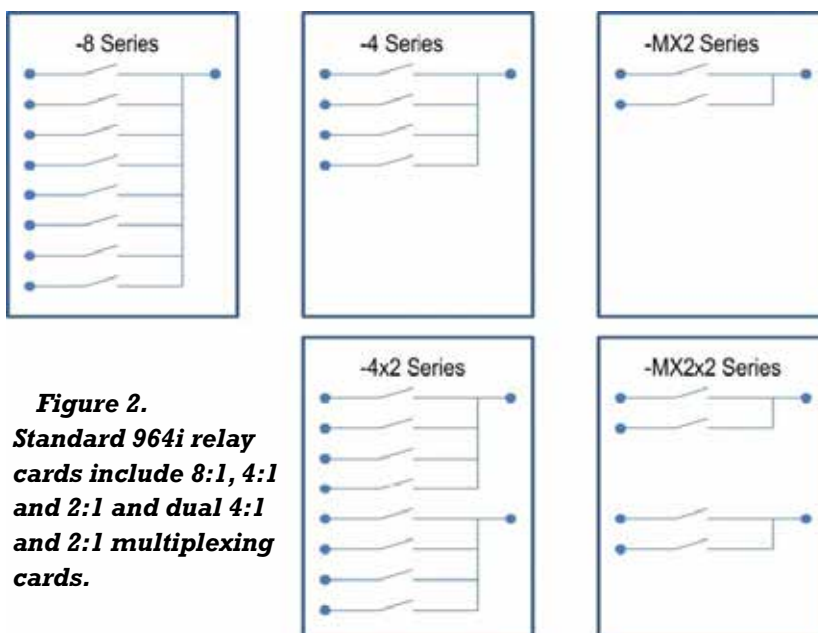


Figure 2.
Standard 964i relay cards include 8:1, 4:1 and 2:1 and dual 4:1 and 2:1 multiplexing cards.

- Select any desired accessories.
- Draw the desired wiring diagram and email it to Vitrek's application team. (This can be a hand drawing photographed and texted to us. We will create a custom configuration for you based on the drawing.)
- Order or create custom fixtures as required.

Standard front inputs connect directly to the hipot tester outputs and up to 60 rear panel terminals connect to the DUT - typically utilizing test fixtures to speed setup and reduce chances of incorrect connections.

Figures 4 and 5 are examples of test accessories available from Vitrek. (see www.vitrekt.com for a complete list of available accessories.)

Up to four 964i units can be controlled directly by a single Vitrek 95x or V7X series hipot tester or up to sixteen via PC/GPIB interface. The 964i's LCD display confirms system status and switch activation at a glance. The result is a highly repeatable, rapid switching test system with no operator intervention and fully automated data acquisition.

Q T Enterprise Software

Vitrekt's QT Enterprise software is the ideal solution for integrating Vitrek's V7x and 95x Series Hipot & Ground Bond Testers with the 964i High Voltage Switching System. For complex setups, QT Enterprise can display detailed instructions and images to the operator to ensure proper connections prior to testing.

QT Enterprise provides a clean and intuitive means for creating and modifying a virtually unlimited number of electrical safety testing procedures. Each test sequence can have as many as 999 steps to



Figure 4. The K2-R lead set is used with the HC-4 card when conducting ground bond tests



Figure 5. The TI-115-2 is one of several test fixtures available to simplify connection to instrument power cords.

perform a comprehensive range of electrical safety tests including AC and/or DC voltage withstand, insulation resistance, ground bond testing and others. Barcode reading of DUT model and serial number assures proper application of required tests.

QT Enterprise only communicates with the tester (and optionally, the switch units) when required to do so. This means that work with QT Enterprise on any computer can be performed to define users, system configurations and/or test sequences

without requiring specific interface hardware or the units themselves.

A complete description of the features and capabilities of QT Enterprise Software is available at www.vitrekt.com.

Conclusion

Multi-point high-voltage and current testing of power connections and cable assemblies can involve dozens and even hundreds of individual point-to-point tests. Performing these test manually is not only a daunting task, but one fraught with the potential for errors. The Vitrek 964i Programmable High Voltage Switching System in combination with Vitrek's high performance Hipot & Ground Bond Testers provide the answer to efficient setup and execution of these tests. Utilizing QT Enterprise software to program the testing sequences further facilitates the testing and documentation of test results.

For more information on Vitrek's line of High Voltage & Electrical Safety & Test Equipment visit us online at www.Vitrekt.com.



Figure 6. QT Enterprise software provides the perfect answer for the setup and operation of complex test sequences.

Glen Broderick, Vitrek Inc.

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