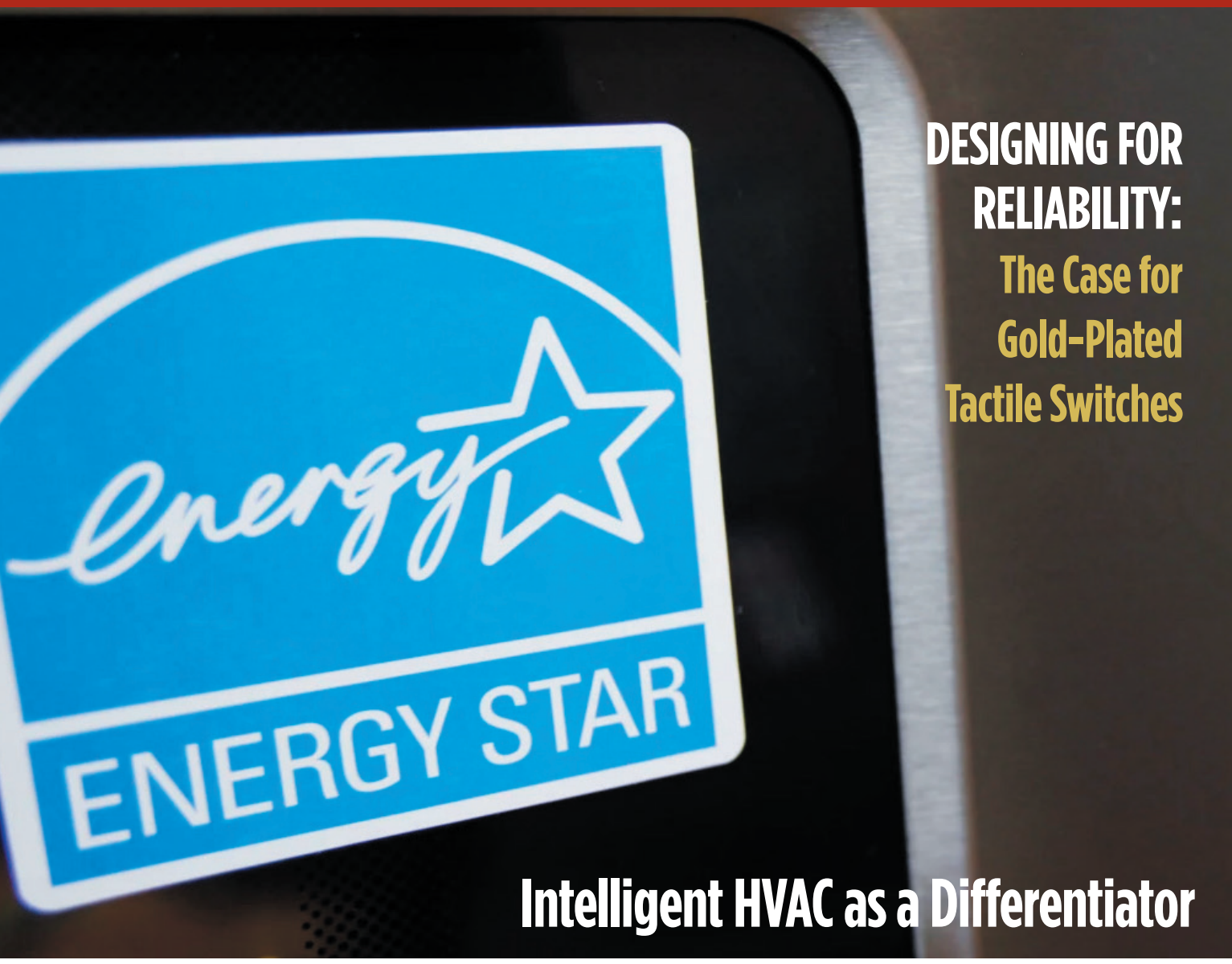
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APPLIANCE & HVAC REPORT

Reaching Design Engineers at the OEM Level

January 2026 www.appliancehvacreport.com VOLUME 8 ➢ NUMBER 1



DESIGNING FOR RELIABILITY: The Case for Gold-Plated Tactile Switches

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ENERGY STAR is recognized as a program that is associated with the environmental efficiency of household appliances. In fact, it's mentioned in the Stuart Scott/TSG RESOLUTE article in this issue. Yet it has come under attack by the Trump administration. For a change however, business leaders (typically Republicans) and even Republicans in Congress are fighting plans to eliminate it.

Lee Zeldin, the administrator of the Environmental Protection Agency, has quietly retreated from plans to eliminate Energy Star. In a rare shift, Mr. Zeldin is reconsidering his May, 2025 announcement that he would end the program, In fact, shortly after Mr. Zeldin said he would eliminate Energy Star, the E.P.A. renewed four contracts with ICF, a consulting firm that helps administer the program. One contract was renewed through September, 2030.

Brigit Hirsch, a spokeswoman for the E.P.A., said in an email that "no final decision has been made at this time" on whether to keep Energy Star.

Since its creation more than 30 years ago, Energy Star has been credited with helping households and businesses save more than $40 billion annually in energy bills, according to a 2023 federal report. The E.P.A. has spent a fraction of that amount — about $32 million to operate the program. That's right, the cost of the program is .08% of the savings.

Zeldin is weighing options for keeping Energy Star in some form, although a final decision has not been made. One option is transferring staff and funding for Energy Star to the Energy Department, which already plays a small role in running the program. Another is requiring appliance manufacturers to pay fees that would help cover the cost of the initiative. Naturally the OEMs are not enamored of this idea.

Either choice would represent an unusual reversal for the E.P.A. In their zeal to terminate what President Trump has called the "green new scam," agency officials have scrapped several other policies that even their allies in the oil, automotive and utility industries were not clamoring to reverse.

Regardless of what Zeldin decides, many E.P.A. employees who work on Energy Star have quit, retired or taken a buyout package since Mr. Trump took office. Other workers in the program have were furloughed as part of the government shutdown or reassigned as part of an agencywide reorganization.

Established under President George H.W. Bush (Bush II), Energy Star was originally intended to curb the energy use of computers. "It caused computer manufacturers to create much more efficient machines and did exactly what it was designed to do," said William K. Reilly, who led the E.P.A. at the time.

Today, the program helps consumers shop for a range of more efficient appliances, including air-conditioners, heat pumps, washers and dryers. It also helps building owners track energy and water consumption to comply with local conservation rules.

"Energy Star is a hugely successful, voluntary program and the Energy Star logo is probably one of the most well-known logos in the country, if not the world," said Francis Dietz, vice president of public affairs at the Air-Conditioning, Heating and Refrigeration Institute (AHRI). Somewhat of an overstatement I think, but we get her point.

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APPLIANCE & HVAC REPORT
Reaching Design Engineers at the OEM Level

Reaching
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at the
OEM Level

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Gold-plated tactile switches offer stable operation for HVAC control systems exposed to heat, humidity, and temperature cycling inside mechanical rooms and service enclosures.

Designing for Reliability: The Case for Gold-Plated Tactile Switches in Home and Building Automation Systems

How advanced contact materials ensure long-lasting signal integrity and user confidence in smart metering, access control, and connected infrastructure

In the era of intelligent buildings and connected infrastructure, **reliability at the component level** determines how well an entire system performs. Behind every smart thermostat, energy meter, and access control terminal lies an array of human–machine interface (HMI) switches that translate user intent into electrical signals. These tactile switches—often hidden within compact, sealed enclosures—must maintain their electrical and mechanical performance over years of continuous operation in variable environmental conditions.

For design engineers in **home and building automation,** specifying the right switch contact material is critical. Gold plating offers unique advantages that directly impact signal stability, corrosion resistance, and long-term reliability. While tin or silver coatings may suffice in cost-driven consumer devices, **gold-plated tactile switches excel in applications that demand precision, durability, and consistent signal integrity**—especially where system uptime and safety are non-negotiable.

Why Gold Plating Matters in Modern Building Systems

Every tactile switch operates through momentary metal-to-metal contact. Over time, environmental exposure—humidity, pollutants, or airborne chemicals—can create oxide films that increase contact resistance or lead to intermittent switching. The plating material determines how resilient those contacts are against these factors.

- **Tin** provides low cost but oxidizes quickly, particularly in humid conditions, leading to rising resistance and unreliable actuation.
- **Silver** offers excellent conductivity but tarnishes in the presence of sulfur, forming insulating sulfides that interfere with low-current signals.
- **Gold,** by contrast, is chemically inert—it does not oxidize or tarnish, maintaining consistent, low contact resistance for the life of the switch.

For **smart building and metering systems,** which often operate with low signal currents and extended service lifetimes, gold-plated contacts offer an essential layer of protection and predictability.

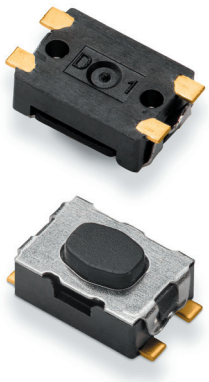
Applications Where Gold Excels

Gold plating provides the greatest value in building automation and

control systems where environmental exposure, long duty cycles, and low operating currents converge.

1. Smart Electricity, Gas, and Water Meters

Meters are typically installed in outdoor or semi-exposed locations, where humidity, temperature swings, and atmospheric pollutants can compromise standard materials. Inside these enclosures, tactile switches are used for configuration, calibration, and maintenance interfaces.



Compact and sealed for demanding environments, C&K's KMR Series gold-plated tactile switches deliver long-life, low-current performance ideal for smart metering and building automation control interfaces.

Gold-plated contacts ensure **stable electrical performance over decades,** resisting corrosion that might otherwise alter calibration or interrupt communication. For example, **C&K's KMR623NG ULC LFG** tactile switch—featuring gold-plated contacts and an IP67-rated sealed design—offers the combination of **environmental protection and long lifecycle performance** that utility metering systems require.

2. Access Control and Security Devices

From smart locks and keypad panels to badge readers and alarm systems, access-control electronics operate in variable temperature and humidity conditions, often near doorways or exterior walls. Gold plating ensures that signal paths remain clean and noise-free, even after years of exposure to moisture and contaminants.



Tactile switches available with gold-plated contacts, like C&K's KSC2 Series, combine long electrical life and stable actuation in compact footprints for HVAC, security, and home-automation applications.

The **KSC223J LFG** switch exemplifies this advantage. With gold-plated contacts, a compact footprint, and robust mechanical endurance, it maintains stable actuation force and resistance over up **to one million cycles**, making it ideal for keypads, security terminals, and building control interfaces that must work flawlessly every time.

3. Smart HVAC and Environmental Controls

Thermostats, air-quality monitors, and lighting control panels are increasingly connected to building management systems. These devices often rely on **microamp-level switching** in their user interfaces and sensor circuits. Gold's oxide-free surface guarantees **consistent conduction** even at very low currents, eliminating false triggers and erratic readings that can occur with oxidized or tarnished contacts.

Engineering Advantages of Gold-Plated Contacts

Stable Electrical Behavior in Low-Current Circuits

In modern IoT-based control systems, switch currents can fall below 10 mA. Under these conditions, oxide films on non-noble metals act as insulators, introducing contact resistance and noise. Gold plating prevents these films from forming, maintaining clean, repeatable signal transmission throughout the product lifecycle.

Reduced Contact Bounce and Noise

Mechanical contact bounce can create unstable signals and false activations. Gold's smooth, uniform surface minimizes micro-asperities that contribute to bounce, resulting in faster, cleaner transitions and simpler circuit design—often eliminating the need for debounce circuitry or software filtering.

Thermal and Environmental Stability

Home and building automation products may experience broad temperature ranges, from unheated meter boxes to sun-exposed outdoor enclosures. Gold's resistance to thermal expansion and contraction preserves contact alignment and mechanical integrity under repeated cycling.

Resistance to Fretting and Metal Whiskers

In high-vibration environments—such as wall-mounted HVAC controls or industrial utility meters—minute contact motion can cause fretting corrosion in conventional materials. Gold's lubricious, oxidation-free surface prevents this degradation. It also eliminates the risk of **tin whiskers,** which can form on other plating types and cause short circuits over time.

Design Considerations and Lifecycle Economics

Gold plating adds a small incremental cost compared to tin or silver, but it provides substantial value in applications where failure costs are high or service access is difficult. In smart meters, for example, each replacement requires a site visit and recalibration—costing far more than the switch itself. Similarly, downtime in building automation systems can disrupt HVAC or security functions and affect user comfort or safety.

By specifying gold-plated tactile switches early in design, engineers can:

- Eliminate field failures caused by corrosion or oxidation.
- Ensure signal reliability in **microcontroller and sensor circuits.**
- Maintain consistent tactile feel and actuation force across millions of cycles.

- Reduce maintenance costs over the product's service life.

Designers can also tailor plating performance through stack configuration—typically a gold layer over a nickel barrier—to prevent copper diffusion and ensure uniform plating thickness.

Real-World Example: Gold Plating Pays Off in High-Heat Appliance Design

A recent design win highlights how gold plating can deliver measurable performance and reliability benefits—even in cost-conscious product segments.

When a **home cooker control module manufacturer** encountered switch reliability issues at elevated operating temperatures, the engineering team turned to a **gold-plated tactile switch** solution. Despite the higher material cost, the gold-plated contacts maintained stable conductivity and tactile feedback across repeated high-temperature cycles—conditions that caused conventional plated contacts to oxidize and degrade.

The result: improved operational reliability, reduced warranty claims, and extended product lifetime.

This case demonstrates that **application-specific demands—particularly exposure to heat, humidity, or prolonged duty cycles—can make gold-plated switches the most cost-effective choice over the product's full lifecycle.**

Balancing Cost, Performance, and Application Needs

While gold plating is not justified in every product, it becomes essential when reliability, environmental resilience, or long lifecycle operation is required. Engineers should evaluate:

1. Current Level: For dry-circuit or signal-level switching (<100 mA), gold plating is recommended.

2. Operating Environment: High humidity, temperature extremes, or pollutant exposure make gold advantageous.

3. Lifecycle Expectations: Long-life meters or access controls with minimal maintenance justify the premium.

4. Tactile Feel and Consistency: Gold's smooth contact surfaces maintain the crisp actuation response users expect.

Switch families such as **C&K's KMR623NG ULC LFG** (sealed, ultra-low current) and **KSC223J LFG** (compact, long-travel, long-life) provide flexible solutions for engineers balancing performance with cost constraints while maintaining footprint compatibility across multiple product platforms.

Building a Foundation for Long-Term Reliability

The home and building automation market is rapidly evolving toward **smarter, more connected, and energy-efficient systems.** As these devices become integral to critical infrastructure—monitoring energy consumption, controlling access, and automating comfort—**long-term switch reliability becomes a foundational design requirement.**

Gold-plated tactile switches meet this challenge by combining electrical precision with mechanical endurance. Their resistance to oxidation, corrosion, and wear translates directly to reduced downtime, fewer service calls, and enhanced product trustworthiness over years of operation.

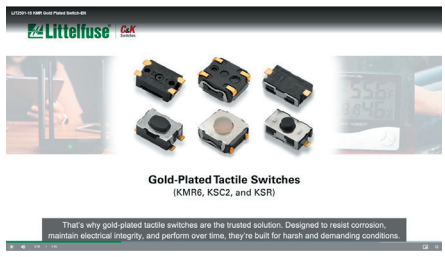
For engineers designing next-generation smart meters, HVAC controllers, or building management interfaces, gold isn't just a material choice—it's a strategic design decision that ensures the connection between user and system remains flawless from the first press to the millionth.

When to Specify Gold-Plated Tactile Switches

- **Smart meters** (electricity, gas, water): Long field life and moisture exposure demand corrosion-proof reliability.
- **Access controls and security panels:** Low-current keypads and badge readers require stable, noise-free contact signals.
- **Smart HVAC and lighting systems:** Continuous operation and low-voltage logic control benefit from gold's oxide-free surface.
- **Outdoor or unconditioned enclosures:** Wide temperature and humidity variation calls for thermally stable materials.

Bottom line: In connected buildings and smart energy systems, gold plating delivers the durability, precision, and signal integrity that keep essential functions running smoothly for decades.

View the video



Michaela Schnelle is a Senior Associate Product Manager at Littelfuse, based in Bremen, Germany, covering the C&K tactile switches portfolio. She joined Littelfuse 16 years ago and works with customers and distributors worldwide to support design activities and new product introductions. She focuses on product positioning, training, and collaboration to help customers bring reliable designs to market.





Building Safer and More Reliable Appliances with Converted Materials and Pressure-sensitive Adhesives

Modern appliance design features elements such as dishwasher LED lighting where converted parts and tapes play a vital role in securing the component and safeguarding for water intrusion

Household appliances have changed dramatically in recent decades. Whereas efficiency was once a selling point, Energy Star® has become the expectation. Whereas digital controls were once considered cutting edge, WiFi connectivity now integrates refrigerators, dishwashers and other units with smartphones and smart-home systems. Whereas showrooms were one full of ''white and boxy,'' today's emphasis is on aesthetics, quiet operation and customization. And whereas manual settings were once the norm, AI applications and sensors now play a growing role, adjusting cycle times, intensities, temperatures and other variables.

But as these machines have evolved from mechanical workhorses to high-tech devices, the pressures on appliance manufacturers have intensified. These pressures include a growing need for material solutions that complement modern designs while being versatile, quickly scalable, lightweight, durable, easy to use and cost-effective. As global supply chains have become less reliable, those solutions increasingly also need to be domestically produced.

To the rescue: Cost-effective, customized, converted parts

To overcome these pressures, appliance manufacturers are turning to cost-effective, functional, custom parts. These parts are made with pressure-sensitive adhesive (PSA) tapes designed and die-cut — or ''converted'' — for specific applications on specific makes and models.

Tape conversion service providers (or just ''tape converters'') can design these parts to address challenges such as mitigating fires, boosting dielectric strength and preventing water ingress/outflow. They're relatively simple to manufacture and can be designed for manual or automated assembly; and that assembly typically is much easier than for parts using bulky mechanical fasteners or messy wet glue systems.

Getting to know PSAs

PSA tapes are the ''backbone'' of these converted parts. When applied correctly, an effective PSA can be relied on to maintain a durable bond for the life of the appliance. As the saying goes, ''failure is not an option.'' PSAs deliver.

In fact, converted parts with PSA tapes are used in a dizzying array of applications across a wide range

of industries. They're specified in automotive, aerospace and military; taken for granted in medical and personal care products; used widely in construction and logistics; and relied on in marine and transportation. That just scratches the surface.

Engineers in these industries have learned that PSA tape solutions provide impressive benefits, including:

- An ability to bond dissimilar and/or low-surface-energy materials.
- Low tooling and capex costs.
- Long-term durability.
- When used as an alternative to mechanical fasteners: lighter weight, slimmer profiles, tighter tolerances, and uniform coverage for even distribution of forces.
- When used as an alternative to wet glue systems: elimination of cure time (leading to higher productivity) and less mess.

And as manufacturers push the limits of what's possible, today's PSA tapes are being engineered to provide advantages that extend beyond bonding:

- Design flexibility
- Easy repositionability
- Multilayer functionality
- Gap filling and sealing
- Dimensional stability
- Encapsulation
- Electrical insulation
- Flame retardance
- Resistance to moisture, chemicals, temperature extremes and UV light

What's in a roll? PSA tape constructions

A typical PSA tape comes from the manufacturer configured as a multilayered roll. These layers include the adhesive, a removable release liner (which protects the adhesive prior to application), and a facestock that adds stability and often some functionality. Several variations of construction are available.

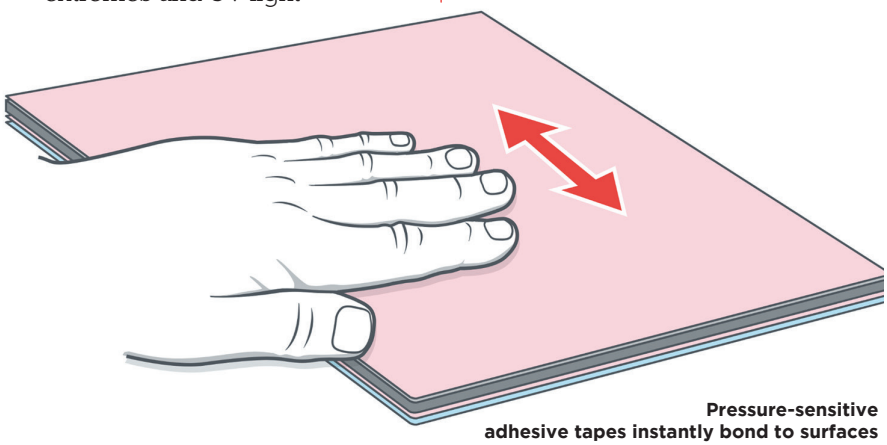
A simple transfer tape, for instance, allows a PSA to be transferred, with no facestock, to a substrate. A complex differential tape, with different adhesives laminated to either side of a facestock, is useful when bonding materials with different properties.

Understanding these configurations, and which type to use when, is important when selecting a tape for an application.

The 1-2-3-4 of tape selection

PSA tapes come in countless varieties. Avery Dennison Performance Tapes, for example, has an adhesive portfolio with more than 1,000 PSA chemical formulations. That's not an atypical number for a leading, global tape manufacturer.

So, a crucial step in developing a PSA tape-based solution for the appliance industry (or any industry) is tape selection. This four-step process typically is the role of the tape converter, working in consultation with both the appliance manufacturer and the tape manufacturer.



Pressure-sensitive adhesive tapes instantly bond to surfaces with minimal force applied

1. The material to which the PSA will be laminated is identified. Typical materials include foams; fibrous nonwovens, felts or fabrics; and films and foils.

2. The surface energy of the substrate to which the PSA will be bonded is identified. Substrates can exhibit surface energies ranging from high to extra low.

3. Any additional end use requirements must be identified. These include factors such as resistance to temperature extremes, moisture, solvents and chemicals, or UV; requirements for shear and tack strength; cost; and any OEM certification requirements.

4. The appropriate tape construction must be identified. PSA tapes are available in numerous configurations, from transfer tapes to multi-layer constructions with differential adhesives.

Tape conversion: Where the magic happens

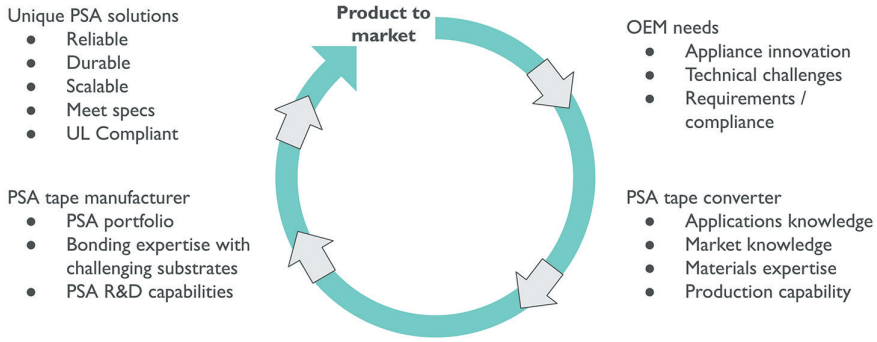
In most cases, a standalone roll of PSA tape from the manufacturer is not enough to meet the needs of an application. Conversion is what adds value to the tape, transforming it into the custom part that's so useful to the appliance manufacturer.

Tape converters provide a wide range of manufacturing processes, with an objective of transforming PSA tapes into ready-to-use materials created to a customer's specifications. These processes include, but aren't limited to:

- **Slitting —** Cutting master rolls of tape into narrower rolls at specified widths.
- **Die-cutting —** Cutting tape into a custom shape. This is especially common for gasketing applications where a precise size/fit is needed.
- **Laminating —** Combining multiple materials, including tapes and other functional materials, into a single ''sandwiched'' construction. This allows the creation of multilayer materials that combine the properties of the component materials: e.g., an easily

repositionable PSA tape with a flame-retardant mica.

- **Kiss cutting —** Creating small parts that can be removed from a larger sheet of liner for peel-and-stick applications.
- **Printing —** Adding brand logos, identification marks or alignment guides to the converted product.
- **Packaging —** Grouping converted parts into kits for assembly-line convenience.



The pressure-sensitive adhesive tape value chain for the appliance segment includes OEMs, converters and tape suppliers. It's important converters are involved in part development from the onset of a program in order to provide effective counsel and manufacturing of components featuring tape.

Trust the process: Working with a tape converter

A converter working with appliance manufacturers should have a solid understanding of the dynamics shaping the industry, its common applications and design trends, and its engineering and production challenges. It should also have the capacity to produce converted solutions cost-effectively, and at the scales needed by those manufacturers.

The converter should also have strong relationships with PSA tape manufacturers, relying on their application and engineering support, and R&D capabilities. The selection of an optimal PSA for an application can be a complex process, so this relationship is crucial. This close relationship can also ensure the converter is fully up-to-date on new tape technologies and capabilities, such as those developed for other industries that can be adapted for use in appliances.

In an ideal workflow, an appliance manufacturer contacts a PSA tape converter, early in the design and engineering (or redesign and reengineering) process. Early inclusion allows the converter to understand a design's challenges, virtually deconstruct that design, then virtually reconstruct it using converted PSA tape solutions to solve those challenges. The converter can then provide prototypes, along with timing/cost projections for scaled production.

The PSA tape manufacturer plays a role as well, providing its portfolio of adhesives and bonding expertise. When necessary, the tape manufacturer can create custom PSA formulations for particularly challenging substrates or application conditions.

Both the tape converter and the tape manufacturer should provide ongoing support. It's not uncommon, for example, for a converter and/or PSA tape manufacturer to be present when a new part is first integrated into an appliance. Imagine a tape converter looking over the shoulder of an ideal first run of a new design or application. This would marry the converter representative working side-by-side with the assembler on the line to provide guidance and troubleshooting during the first few applications of a PSA tape solution. That's the level of support the appliance manufacturer should expect from its converter.

Three real-world appliance engineering challenges — and practical, converted PSA tape solutions

My company, TSG Resolute, has worked with appliance manufacturers to develop and introduce to the market a wide range of converted PSA tape solutions. Each solution has addressed real-world design and engineering challenges.

Three of the most common challenges we address are fire prevention, dielectric strength and water barriers. Here are some examples to give you an idea of what a PSA tape part can do.



Challenges in today's appliance design



Fire prevention and mitigation



Dielectric barriers and contact short prevention



Water/moisture barriers

Challenge: Fire prevention and mitigation

Preventing and mitigating fires is one of the most critical of the challenges faced by appliance manufacturers. The "standard" fire mitigation solution, however, involves incorporating fire-retardant additives into plastics for use in crucial areas of a unit. This adds cost (the additives are costly and increasingly difficult to obtain) and can produce toxic fumes when heated plastic begins to melt.

A PSA tape solution for this challenge involves production of a box made of aramid fiber. It's bonded into place around crucial components (wiring, electronics, high voltage inputs, high voltage boards, etc.) to encase them and isolate any flames at their point of origin.

Such a solution is lightweight, compact, and easy to assemble and install. It's also cost-effective and non-toxic and compliant with UL® V-0 5VA.

Challenge: Dielectric barriers and contact short prevention

As appliances integrate more digital technology, their engineering, power usage, and circuitry become ever more complex, all while the cavity area and space to house these new boards shrink, thus raising the likelihood of electrical shorting.

Modern PSA tape solutions are custom-designed for an application. They combine various dielectric materials, including polymeric solutions, films, and foils at various thicknesses and strengths. These are integrated with PSA solutions appropriate to the substrate. All of this requires a converter with a deep understanding of appliances and the specific application.

Challenge: Water/moisture barriers

No homeowner wants to wake up to discover their kitchen floor soaked through from a leaky dishwasher or washing machine. But as appliances evolve to include more features — LED lights, buttons, ports — so increase their potential leak points.

Silicone or polyurethane gaskets made with water- and heat-resistant PSA tapes are a UL-compliant, simple and cost-effective solution. Again, such materials can easily be custom-engineered for specific placement on a specific make and model, ensuring the best possible fit.

Modern appliances need modern material solutions

The bottom line? Modern appliances need modern material solutions that are versatile, durable and cost-effective at the scales you need. Converted parts made with PSA tapes are the answer. And you have partners ready to help you create those solutions.

So the next time your design and engineering team kicks off a new project, consider giving a seat at the table to a tape converter.

Stuart Scott is the Chief Operating Officer of TSG Resolute

Based in Americus, Georgia, TSG Resolute provides a wide range of converted part services, including die-cutting, lamination, metal fabrication, plastic extrusion, composite panels and robotic assembly. The company serves the appliance industry directly, along with other industries with similar needs such as automotive, construction, electronics, lighting, medical, and transportation.





Intelligent HVAC as a Differentiator

How intelligent HVAC systems are redefining comfort, cost, and sustainability in Hospitality and Multifamily Housing

Intelligent HVAC is emerging as a core driver of performance and sustainability across the built environment, more than just a hospitality amenity. Buildings account for roughly 30% of global final energy use and nearly one-third of energy-related carbon emissions, making smarter climate control a central lever in decarbonization and operational efficiency (IEA, 2024). At the same time, the intelligent HVAC market is projected to grow steadily—driven by rising energy costs, ESG reporting requirements, and occupant expectations for more thoughtful indoor environments; forecasts estimate 7%+ annual growth through the next decade (Grand View Research, 2025). In hospitality and multifamily settings – where comfort, cost, and retention are tightly linked – intelligent HVAC systems that leverage real-time sensing and AI-based control are rapidly shifting from ''nice to have'' to standard infrastructure that delivers better comfort outcomes with lower lifetime operating expense.

For owners and developers, intelligent HVAC is no longer just about heating and cooling. It's about reducing carrying costs during construction, protecting RevPAR (Revenue Per Available Room) through uptime, and elevating brand perception through design and comfort. Innovative integrated systems demonstrate this shift by transforming mechanical coordination headaches into a simple, pre-engineered solution that installs faster, performs smarter, and lasts longer.

HVAC Moves from Back-of-House to Brand Experience

HVAC has long been treated as background infrastructure—essential but invisible. Developers and operators were historically focused on visible amenities, but a shift is underway: intelligent HVAC is becoming a direct driver of guest and resident experience, operational efficiency, and ESG performance (Sturgell, 2024; Architect Magazine, 2025).

In hospitality and multifamily settings, brand perception increasingly hinges on how a space feels. Consistent temperature control, quiet operation, and good air quality directly shape comfort and overall satisfaction. When HVAC is loud, uneven, or difficult to adjust, guests notice; when it's seamless and unobtrusive, the environment is perceived as more premium, intentional, and well-managed.

Sustainability expectations reinforce this shift. Intelligent HVAC systems that reduce energy waste and provide transparent performance data support brands that position themselves as responsible and wellness-focused. As a result, HVAC is moving from ''back-of-house'' to a core element of the brand experience, influencing loyalty, reviews, and long-term value (MFE Magazine, 2025).

Intelligence by Design

Traditional HVAC systems operate reactively, cycling on or off based solely on thermostat thresholds. This results in wasted energy, noticeable temperature swings, and inconsistent comfort. Intelligent HVAC offers more proactive models, for example, that embed an on-board processor and machine learning models that interpret real-time data — including temperature, humidity, occupancy, time of day, and human behavioral patterns — to continually refine how the system responds (AIIR Technical Brochure, 2025).

Rather than waiting for the room to drift into discomfort, newer systems anticipate it. The AI engine predicts environmental changes and adjusts compressor speed, blower intensity, and airflow direction in milliseconds. This allows the system to not only



optimize energy output, but also optimize comfort, creating a stable, quiet, and personalized climate that feels designed rather than mechanical.

This matters because comfort is experienced moment to moment. When temperature shifts are gradual instead of abrupt, when airflow is balanced instead of drafty, and when the system fades into the background instead of calling attention to itself, people feel more relaxed and rested in a space. In hospitality and multifamily environments — where the "feel" of the room drives satisfaction and return behavior — this isn't just operational efficiency. It's experience design.

AI turns HVAC from a reactive utility into a learning system—one that becomes better at delivering comfort the longer it runs. The technology transforms HVAC into a learning system that improves the longer it runs.

Comfort as a Revenue Driver

Comfort has quietly become a defining amenity in modern living and travel; it's the first thing guests expect and the factor they most immediately feel. Before they evaluate the lobby design, brand story, or service culture, they register whether the room feels good: Is it the right temperature? Am I aware of the HVAC operating? Can I sleep comfortably? Comfort sets the baseline for every other impression; when it's off, every other amenity has to work harder to compensate.

Comfort is no longer an intangible amenity. It's now a measurable financial lever. HVAC downtime directly reduces available inventory, impacting RevPAR, while noise or poor sleep quality depresses guest reviews and ADR (Average Daily Rate).

Smart manufacturers are addressing both sides of the equation with predictive maintenance platforms that identify service needs before failure occurs. This pre-planning allows proactive component swaps without guest disruption—protecting room availability and revenue continuity.

At the same time, quieter operation and precise thermal control enhance the lived experience of the space. Guests rest better. Rooms feel more intentional. Satisfaction and loyalty increase. In extended-stay and lifestyle-driven properties — where consistency and ease shape emotional connection — the results include higher repeat bookings and measurable NOI gains.

Operational and ESG Advantages

AI-driven HVAC doesn't just elevate comfort; it improves building operations and pushes the industry closer to truly sustainable, next-generation building envelopes. Real-time monitoring and predictive diagnostics surface issues like airflow imbalance or component wear before failure, reducing downtime and extending equipment life (Sturgell, 2024).

Intelligent HVAC systems simplify servicing. Low-refrigerant, self-contained designs don't require specialized HVAC labor for installation or repair, lowering both construction complexity and ongoing maintenance costs. If a unit needs replacement, operators can perform a quick swap in under an hour, keeping rooms rentable and revenue uninterrupted.

When an HVAC unit is a fresh-air-source heat pump, it eliminates the need for separate DOAS units and associated ductwork. This reduces materials, coordination demands, and building penetrations, lowering construction risk and supporting tighter, more efficient building envelopes.

From an ESG standpoint, AI modulation ensures that systems use only the energy required at a given moment, directly supporting carbon reduction and efficiency goals (Architect Magazine, 2025). Owners increasingly view intelligent HVAC as insurance, guarding against energy volatility, service delays, and guest dissatisfaction tied to comfort inconsistency.

Case in Point: Hotels Discover the ROI of AI

Hotels are among the earliest adopters of intelligent HVAC because comfort directly impacts revenue. A Halifax Marriott property that implemented AI-driven HVAC controls achieved a 24.5% reduction in natural gas usage and a 3% reduction in electricity consumption within five months (Green Lodging News, 2024). These savings compounded across multiple properties translate into millions annually.

In addition to reduced operating costs, AI systems drive brand differentiation. Today's guests associate comfort and sustainability with trust and loyalty. Hotels deploying intelligent HVAC can not only lower energy bills but also mitigate maintenance calls and achieve higher satisfaction scores (Sturgell, 2024).

Multifamily and Mixed-Use: The Intelligent Living Standard

In multifamily developments, intelligent HVAC systems meet residents' increasingly high

expectations by delivering both connectivity and control (MFE Magazine, 2025). Onboard Wi-Fi, Bluetooth, and BMS integration allow building managers to oversee entire properties remotely, while residents can fine-tune conditions through mobile apps or voice assistants.

Over time, these systems learn occupancy trends and automatically adjust performance to conserve energy in unoccupied spaces. This adaptive operation is particularly valuable in mixed-use, hospitality, and student housing, where occupancy patterns vary widely and change frequently. In these environments, intelligent HVAC can connect directly to building management systems (BMS) or guest room management platforms to provide a unified view of energy performance across the entire property. This enables operators to:

- Optimize energy use on a building-wide basis
- Automate scheduled setbacks or load management during peak demand
- Support carbon accounting and ESG reporting with real-time performance data
- Apply custom settings by floor, unit type, or occupancy status

For hotels, multifamily, and student housing operators, this level of orchestration turns climate control into a coordinated system rather than a collection of isolated units, delivering both efficiency and a more intentional, consistent living or guest experience.

The Human Factor: Designing for Wellness

Indoor environmental quality has become a measurable health consideration, not just a comfort feature. Research continues to link better air quality and temperature stability to improved cognitive performance, sleep quality, and overall well-being. Intelligent HVAC systems continuously monitor indoor air conditions and automatically adjust ventilation, dehumidification, and filtration as needed to sustain those wellness outcomes (Architect Magazine, 2025; Green Lodging News, 2024).

Filtration is also a critical part of that equation. That's why intelligent units come standard with MERV 8 and MERV 13 filtration, the same high-efficiency filter grades many operators are now required to upgrade to under-evolving indoor air quality codes and WELL/Fitwel pathways. While many legacy systems must be retrofitted or redesigned to accept higher-grade filters (often at added static pressure and energy cost), some have these filters as standard, enabling buildings to meet compliance requirements without compromising airflow, unit efficiency, or serviceability.

In hotels, the impact is immediate: better sleep, fewer noise and comfort complaints, and a noticeable sense of air freshness that improves guest perception from the moment they enter the room. In multifamily environments, consistent indoor air quality improves daily living comfort and can directly support WELL, Fitwel, and ESG-aligned health metrics. By maintaining clean air and balanced humidity regardless of outdoor conditions, intelligent HVAC positions wellness not as a luxury, but as a baseline standard of living.

A Connected Future

The next generation of HVAC intelligence is collaborative through integration with grid-interactive smart buildings, allowing systems to communicate across properties and adapt to peak demand conditions (MFE Magazine, 2025). By aggregating data, these systems can learn patterns not just within a unit, but across entire portfolios, predicting energy peaks, identifying outliers, and suggesting optimal system configurations.

For OEM design engineers, this evolution signals a shift from mechanical engineering to data-driven ecosystems. Future HVAC systems will deliver comfort through self-optimization, self-diagnosis, and integration with broader smart-building networks, becoming an essential component of the modern built environment.

The Takeaway: Comfort, Cost, and ROI

HVAC is no longer just equipment behind the wall—it's a defining part of how a building feels, and that feeling shapes how people remember a stay or a home. Intelligent HVAC shows how comfort, quiet, and air quality can be delivered intentionally and consistently, while also lowering operating effort and supporting sustainability goals.

For hospitality and multifamily brands operating across multiple properties, the ability to deliver the same high-quality experience everywhere is critical. Intelligent HVAC allows that experience to scale, so a guest or resident knows exactly what kind of comfort they'll get, no matter the location. And when comfort is consistently good, people are more likely to recommend, return, and stay longer.

This soon becomes real ROI—not just from energy savings, but from loyalty, trust, and preference. A building that feels better earns repeat business. A brand that feels consistent earns lasting credibility.

The future of climate control isn't just smart, it's intentionally designed for how people live, stay, and feel. Intelligent HVAC has moved from background utility to a core part of brand experience and long-term value.

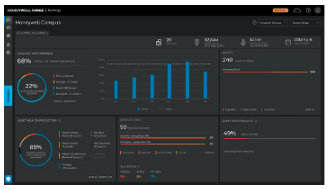
By Trevor Schick,
CEO at AIIR Products and Slate Technologies

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What's Happening

2026 AHR Expo Innovation Award Winners

1. Building Automation



- **Winner: Honeywell**
- Innovation: Honeywell Connected Solutions
- Honeywell's Connected Solutions suite empowers building owners and service providers with cloud-based tools for remote monitoring, predictive maintenance, energy optimization, and asset lifecycle management. These applications streamline operations, reduce costs, and enhance sustainability, all through a unified, intuitive platform that transforms traditional building management into a connected, data-driven experience.

2. Cooling



- **Winner: Daikin Applied Americas Inc.**
- Innovation: Magnitude WME-C Quad
- Magnitude WME-C Quad is the first dual circuit series counterflow chiller that delivers up to 3,000 tons of capacity using Daikin's magnetic bearing compressor technology. With four compressors, Daikin's proven WME oil-free magnetic bearing technology and mission-critical features like RideThrough and RapidRestore, it offers unmatched part-load efficiency, reliability and uptime.

3. Heating



- **Winner: Copeland**
- Innovation: Copeland heating-optimized modulating vapor injection portfolio
- The Copeland heating-optimized modulating vapor injection portfolio combines innovative two-stage, tandem and variable-speed compression platforms with enhanced vapor injection (EVI) technologies to deliver maximum flexibility, scalability and performance in achieving the capacity and efficiency requirements of next-generation commercial heat pumps.

4. Indoor Air Quality



- **Winner: Sharp Corporation**
- Innovation: Airest
- Airest is the world's first mini-split heat pump with built-in MERV 14 certified filters. It captures over 99.9% of dust before it enters the unit. With an airflow reach of 43 feet, Airest cools, heats, and purifies the air simultaneously, all made possible by its uniquely engineered internal structure.

5. Plumbing



- **Winner: IDC Fluid Control**
- Innovation: LeakStop III
- LeakStop III is a fully automated water leak detection system for homes and small commercial buildings. The system is built to alarm in the event of a leak detection. When the water flow is continuous and exceeds a preset and programmable maximum value, the system automatically shuts down.

6. Refrigeration



- **Winner: Copeland**
- Innovation: Copeland transcritical CO2 scroll compressor with dynamic vapor injection technology
- The Copeland transcritical CO2 scroll compressor marks a new era of simplicity, scalability and sustainability for small-footprint, distributed CO2 refrigeration. Featuring dynamic vapor injection (DVI) technology, which enhances efficiency and simplifies design, the transcritical-rated compressor revolutionizes CO2 refrigeration system designs and applications in North America.

7. Software



- **Winner: Rebar**
- Innovation: Rebar
- Rebar is described as the first AI-powered takeoff platform built for HVAC. It reads construction plans, identifies mechanical pages, marks equipment, and generates accurate takeoffs in minutes.

8. Sustainable Solutions



- **Winner: Blue Frontier**
- Innovation: BF-DOAS
- The BF-DOAS (Blue Frontier Dedicated Outdoor Air System) is a sustainable air conditioning system that uses a liquid desiccant instead of traditional refrigerants to dehumidify and ventilate fresh air. The system is designed to improve indoor air quality and energy efficiency by pre-conditioning 100% outdoor air to a desired temperature and humidity level before it enters a building's main HVAC system.

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9. Tools & Instruments

- **Winner: CSG Compressors (Houston & American Hermetics)**
- Innovation: SAMMi
- SAMMi is an AI-powered HVAC monitoring and dispatch system that detects issues before they cause breakdowns. It autonomously alerts and dispatches technicians, saving time, money, and product loss.



10. Ventilation

- **Winner: ABB Motors and Drives**
- Innovation: ACH580 Variable Frequency Drives
- The ACH580 drive enables seamless control of up to six EC Titanium motors, optimising energy efficiency, reducing installation complexity, and lowering total cost of ownership.



Infinitum Appoints Vikas Desai as Chief Commercial Officer

''Infinitum's motor technology is transformational and the opportunity to grow the company and make a positive impact is massive.'' — ''I look forward to working alongside Ben and the entire team to deliver meaningful and enhanced value to our customers and partners, and help broaden the company's reach.''- Vikas Desai, Chief Commercial Officer

AUSTIN, Texas–(BUSINESS WIRE)–Infinitum, creator of the sustainable air-core motor, today announced the appointment of Vikas Desai as Chief Commercial Officer. Vikas will oversee Infinitum's commercial efforts and revenue growth.

Vikas brings three decades of customer-focused leadership experience to Infinitum, having built and scaled multiple global businesses across the solar energy and technology sectors. Prior to joining Infinitum, Vikas served as Chief Commercial Officer of Maxeon Solar Technologies where he oversaw the company's commercialization strategy.

Vikas has held prior leadership roles as CEO of Powerside, CEO of EchoFirst, SVP of Flextronics, SVP at SunEdison and as General Manager at SunPower, where he successfully scaled the global distributed generation business from its inception to $1 billion in revenue within five years.

''We're excited to welcome Vikas to Infinitum and further strengthen our customer-centric culture, commercial partnerships and market leadership. His ability to build strong relationships and track record of scaling companies that prioritize customer needs and value will be a tremendous asset going forward,'' said Ben Schuler, founder and CEO, Infinitum. ''Vikas's appointment comes at a time of rapid growth among our customer base and his addition will further fuel our next phase of expansion.''

''Infinitum's motor technology is transformational and the opportunity to grow the company and make a positive impact is massive,'' said Vikas Desai. ''I look forward to working alongside Ben and the entire team to deliver meaningful and enhanced value to our customers and partners, and help broaden the company's reach.''

Locking Ring Terminals Provide HVAC Connection Integrity



A full line of locking ring electrical terminals that prevent twisting and rotation during the manufacture and shipping of HVAC equipment has been introduced by ETCO Incorporated of Bradenton, FL.

ETCO Locking Ring Terminals feature four teeth that extend 0.023'' from their surface with each tooth having a 40-degree angle that provides sharp wedges which bite into painted or plain metal surfaces to stay in place. Maintaining connection integrity during the manufacture and shipping of HVAC equipment, they prevent rotation, arcing, and electrical shorts.

Ninety-two percent of the thickness of the ring itself, the teeth on ETCO Locking Ring Terminals penetrate into plain or painted metal surfaces to withstand vibration and prevent twisting and rotation which can cause short circuits. These locking ring terminals attach to 12-22 gauge wire using an F-crimp for a more secure connection than conventional flag ears.

ETCO Locking Ring Terminals are priced according to size and quantity; manufactured in the USA to eliminate supply chain issues. Evaluation samples are available upon request.



Amerikooler Introduces FlexiCool ProBox Portable Refrigeration Solution

The ProBox model is fully portable, suiting multiple industries.

Amerikooler, a commercial refrigeration solutions company, announces the launch of the FlexiCool

ProBox, a portable cooling unit designed to meet the refrigeration needs of various industries. This versatile solution is engineered to enhance both temporary and permanent refrigeration setups, providing key features that deliver significant benefits for businesses.

The FlexiCool ProBox boasts a pre-built, all-in-one design with a specially reinforced structure that ensures durability and facilitates transport. Delivered fully assembled, the unit minimizes setup time and labor, allowing for rapid deployment.

Engineered with a threshold design for entry and exit, the FlexiCool ProBox incorporates modernized trims and NSF-certified coving. The threshold minimizes gaps, reducing air exchange between the cooler and the outside environment. This decreases the workload on the refrigeration system and protects against moisture. Additionally, the threshold is constructed with high-quality materials, such as stainless steel or reinforced composites, to resist damage from frequent use and heavy traffic. To enhance safety, non-slip surfaces or integrated anti-skid features improve traction, reducing the risk of slips and falls in high-moisture environments.

Featuring a hybrid self-contained low-profile refrigeration system, the FlexiCool ProBox offers a space-saving design without sacrificing cooling performance. Its energy-efficient system integrates essential components for maximum reliability, making it suitable for both temporary and long-term refrigeration needs across various events and locations.

The unit includes integrated and removable forklift holes that facilitate easy unloading and placement at job sites. These slots can be removed after installation to maintain a clean and professional appearance. Additionally, reversible exterior trims can be flipped to serve as anchors, securing the unit to the ground.

For businesses requiring mobility, the FlexiCool ProBox is equipped with lockable wheels that secure the unit when stationary while allowing for effortless relocation when needed.

The FlexiCool ProBox represents an advancement in portable refrigeration technology. By combining features with practical design elements, it addresses the needs of customers across various secto.



Avery Dennison Signs Agreement to Buy Flooring Business of Meridian Adhesives Group

Avery Dennison Corp. has signed a definitive agreement to acquire the U.S.-based flooring adhesives business of Meridian Adhesives Group for the purchase price of $390 million. The acquisition is subject to certain customary closing and post-closing adjustments. Avery Dennison expects the transaction to close in the fourth quarter. It is not expected to have a material impact on the company's adjusted earnings per share in 2025.

Avery Dennison reports that Meridian's flooring adhesives business is a leader in the development, manufacture, and commercialization of specialty adhesives and coatings for the U.S. flooring industry, with projected 2025 revenue of approximately $110 million and attractive operating margins. Headquartered in Dalton, Georgia, it operates four manufacturing facilities in the United States and employs approximately 110 people.

"Avery Dennison remains sharply focused on expanding in high-value categories, both organically and through M&A," said Deon Stander, Avery Dennison president and CEO. "This acquisition will leverage our materials science capabilities, while deepening our specialty adhesives solutions, with a business that is highly regarded within the floor covering industry for its product quality, strong customer relationships, and continuous innovation."

Upon completion of the transaction, the flooring adhesives business will become part of the Avery Dennison Materials Group business. The Meridian flooring adhesives business includes Taylor Adhesives, Polycom, and Frontier Products' brands.

"This acquisition is an excellent fit with Materials Group," said Ryan Yost, president, Avery Dennison Materials Group. "It adds a valuable set of application-oriented solutions in high-value categories to our adhesives portfolio. We see strong cost and technology synergies that will build on our materials science capabilities, acrylic adhesive expertise and open new application opportunities for us in the flooring industry."

Ralph Grogan, commercial president of flooring, Meridian, added, "I am incredibly proud of what our teams at Taylor Adhesives, Polycom and Frontier Products have built. With Avery Dennison's backing and reach, these brands are well-positioned to continue growing and delivering even greater value to our customers."

Learn more about Avery Dennison at www.averydennison.com. Additional information about Meridian Adhesives Group is available at meridianadhesives.com.



Cybersecurity Compliance Evaluation and Testing

D.L.S. performs cybersecurity compliance testing and evaluation services for devices and equipment that have Bluetooth, Wi-Fi or other wireless connectivity in them and require additional confirmation of secure communications and

ASGE

AMERICAN SOCIETY OF GAS ENGINEERS

In 1954, eight engineers concerned about the future of the gas appliance industry met in Cleveland, Ohio and formed the Gas Appliance Engineers Society.

The first chapter of the Gas Appliance Engineers Society (GAES) was established by letter dated April 25, 1956 from National Board of Trustees (E.J. Horton, A.F. Craver, S.C. Marshall, G.W. Griefnow, M.J. Caparone, K.T. Davis, H.M. Reeves) to Mr. M.J. Caparone, Grayson Controls Division, Robertshaw-Fulton Controls Co. Twelve Chapters of the Society operated during the period from 1956 to 2006.

Members met on a regular basis to discuss gas appliance design and safety, and the proper application of new technologies. The Society had many benefits for its members besides being able to share what they knew. A genuine camaraderie developed and a feeling that as fellow engineers, they were part of a profession.

In 1958 the GAES name was changed to the American Society of Gas Engineers (ASGE). Members wrote papers to build a database of knowledge; scholarship funds were established; and members were honored for achievements in the industry as well as with ASGE. In addition to gas appliance design engineers, ASGE enjoyed broad support from gas utilities, gas appliance certification agencies, and others who saw the benefits that ASGE brought to the gas industry.

ASGE also represented a proud tradition of volunteerism, giving members an opportunity to give back to industries that had given them so much. Members pooled their talents to put on gas schools, seminars and technical conferences to share their knowledge. This allowed members to not only hone their technical skills, but their organizational skills as well. Members became better communicators in the process. They developed solid skills that they could use to build their careers.

Today, the enthusiasm for ASGE still runs high but lifestyles have changed. Leisure time has been reduced as companies demand that engineers put more time into their work. The globalization of the gas industry has spread members geographically and has caused more frequent career changes. The members of ASGE have realized that the Society must change with the times.

Our Objectives

To promote the education and professionalism of its members and to make available to the public technical and scientific information and knowledge.

The objectives of the Society are accomplished by:

1. Advancing the theory and practices of gas engineering and the allied arts and sciences in the interest of the environment and conservation.
2. Promoting the safe, efficient and ecologically compatible utilization of gas.
3. Maintaining high standards of safety in the design of appliances and equipment and the utilization of gas technology.
4. Promoting a broader understanding of industry challenges and requirements.
5. Promoting standardization of terminology, techniques and laboratory testing methods.
6. Encouraging research and innovation in the gas industry.
7. Providing forums and media through which experiences and information of common interest and benefit to the Gas Industry may be reported, discussed and disseminated for the common good.
8. Offering recognition to encourage meritorious technological contributions to the industry and participation in the Society.
9. Encouraging students and young engineers to enter the Gas Industry.

Benefits

The benefits from ASGE membership include the opportunity to share in the Society's educational programs and constructive activities; to explore and advance related interests with fellow professionals; and to represent one's company as a person responsive to progress and interest in the well-being of the Gas Industry.

Other benefits are the opportunity to express and relate new industry experiences; industry-wide contacts and incentive to further one's talent for leadership as a Committee Member or National Officer.

Special contribution to ASGE and noteworthy achievements are acknowledged by the Society with the publication of citations and presentation of Honor Plaques to either the individual or to a company.

GAS APPLIANCE MANUFACTURERS Comprise the majority of ASGE members. Manufacturers share information with others who design, develop and manufacture products. Globalization, changes in gas, and environmental concerns are some of the issues that demonstrate a real need to bring the industry together to re-think and re-shape the future of gas appliance.

CONTROL MANUFACTURERS Work with appliance manufacturers to develop control solutions for modern gas appliances. They need access to information on changing regulations in order to develop products in a timely and efficient manner. Participation in ASGE offers access to the gas industry as a whole.

INDUSTRIAL EQUIPMENT BUILDERS Face all the issues of the gas appliance designer, but on a larger scale. Concerns regarding safety, performance and environmental issues are universal and participation in ASGE benefits this industry group as well.

CERTIFICATION AGENCIES Assist the gas industry in regards to standards and certification. This is a key element of the gas appliance marketplace by pushing for broader market acceptance by new product designs. These agencies benefit from ASGE membership by interacting with the industry.

GAS UTILITIES Have an opportunity to provide feedback to manufacturers and to learn what to expect from the gas appliance designers of tomorrow by attending ASGE Technical Conference and providing input for technical articles on the ASGE website.

network protection and useability.

These requirements are becoming more formalized in the various countries that utilize IoT devices, equipment, and technology. Current aspects are referenced below:

United States

The FCC is currently creating the "U.S. Cyber Trust Mark" to eventually be implemented for IoT products sold in the U.S. There is no word at this time as to the contents and when it will take effect.

On December 11, 2024, the Federal Communications Commission's Public Safety and Homeland Security Bureau announced the agency's voluntary cybersecurity labeling program for wireless consumer Internet of Things (IoT) products.

"The program will allow qualifying consumer smart products that meet critical cybersecurity standards to display a label, including a new U.S. government certification mark ("U.S Cyber Trust Mark"), which will help consumers make informed purchasing decisions, easily identify trustworthy products, and encourage manufacturers to prioritize higher cybersecurity standards. The voluntary program will be a collaborative effort between the public and private sectors, with the FCC retaining ultimate oversight and control of the program and authorized third-party administrators managing activities such as evaluating product applications, granting permission to use the label, and educating consumers."

This program is still in its infancy, but additional updates will be forthcoming.

Canada

Canada is currently creating the "CyberSecure Canada Mark" for products sold in Canada. There is no word at this time as to the contents and when it will take effect.

European Union

Radio Equipment Directive (RED) Cybersecurity Requirements

On August 1, 2025, the Radio Equipment Directive (RED) Cybersecurity Requirements for the European Union will go into effect for selling products placed into the market in Europe. These requirements are referenced below as part of Article 3 of the directive.

The three points of the second subparagraph of Article 3 (3) are relevant for compliance under the cyber security requirements:

- 3(3)(d) to ensure network protection
- 3(3)(e) to ensure safeguards for the protection of personal data and privacy
- 3(3)(f) to ensure protection from fraud

The following IoT/Wireless products must comply:

- Devices capable of communicating over the Internet (either directly themselves or through another device, like a smartphone)
- Toys and childcare equipment
- Wearables (smartwatches, etc.)

The newest harmonized standards listed by the European Union the EN 18031 series in the Official Journal of the European Union under the Radio Equipment Directive (RED), were added in January 2025. This standard series was developed to provide manufacturers of radio equipment with a harmonized framework to meet the cybersecurity requirements that become mandatory on August 1, 2025.

- EN 18031–1:2024: Part 1: Internet connected radio equipment
- EN 18031–2:2024: Part 2: radio equipment processing data, namely Internet connected radio equipment, childcare radio equipment, toys radio equipment and wearable radio equipment
- EN 18031–3:2024: Part 3: Internet connected radio equipment processing virtual money or monetary value

Other standards for industrial products and controls, machinery, and other product categories are in development.

There are exemptions for specific products, and if your product is in one of the "vertical standards", then there will be a special ETSI TS standard for you. We can help you figure this out, and also which provisions of the standard you must comply with.

More details can be found at:

Cybersecurity Requirements under the Radio Equipment Directive (RED) 2014/53/EU

EU Machinery Directive

Cybersecurity requirements for the EU Machinery Directive are planned to go into effect in 2027.

Shout it from the (solar-powered) rooftops! New campaign helps families use home upgrade credits before they expire



The Save on Better Appliances campaign is helping households future-proof their energy bills.

Three years after the passage of the Inflation Reduction Act (IRA), Rewiring America is launching the Save on Better Appliances campaign, a nationwide effort to help homeowners lock in valuable energy tax credits before they expire at the end of 2025, while also showcasing new pathways to long-term energy affordability.

With energy costs on the rise, the campaign emphasizes how modern electric appliances — like heat pumps, heat pump water heaters, and rooftop solar — can help families cut bills, boost comfort, and protect

themselves from future price shocks.

Americans are feeling the squeeze from record-high energy costs, driven by extreme heat, rising demand from data centers, and stubborn inflation pressures. For many families, energy-efficient appliances represent one of the only ways to regain control over household costs, a benefit that endures even after federal incentives expire. Beyond the federal Energy Efficient Home Improvement Credit (25C) and Residential Clean Energy Credit (25D), there are still thousands of state, local, and utility-level incentives available to help families bring down upfront costs and make these critical upgrades possible.

''These popular federal credits were designed to be available when American families needed them,'' said Ari Matusiak, CEO of Rewiring America. ''Congress's decision to repeal them prematurely means households should act fast. But the savings, comfort, and long-term value of these upgrades remain. For homeowners ready to act, we have the tools to help. And for those who need more time, we're working to expand your options and ensure that these upgrades make financial sense whenever the moment is right.''

The Save on Better Appliances campaign will run through the end of October and includes:

- A central hub where homeowners can learn more about the expiring federal tax credits, explore additional state, local, and utility incentives, and find trusted contractors.
- Weekly Zoom drop-in sessions with Certified Electric Coaches — free, informal guidance to help homeowners troubleshoot the complexities of making energy-efficient home upgrades. Sign up for the first session on Wednesday, September 3 here!
- Trusted contractor tools, including Rewiring America's Contractor Finder, which will soon integrate the BetterHVAC directory to help households find the best-qualified installers.
- A new Single-Project Personal Electrification Planner that makes it easier than ever for homeowners to start their electrification journey — with a streamlined path for the most common projects like heat pumps, energy audits, and electric upgrades.
- A national storytelling push from contractors and homeowners who know firsthand the comfort, health, and pocketbook benefits of these upgrades.

Tax credits are just one tool to make home energy upgrades more affordable. That's why Rewiring America is partnering with manufacturers, contractors, and lenders to offer specially priced heat pump packages in Rhode Island and Colorado, with more locations to come. These offers are available now and will expand in 2026 and beyond, lowering upfront costs and expanding access — no matter what happens in Washington.

Across the country, state agencies, utilities, local governments, and nonprofit coalitions are leading additional creative solutions to help families save money, access trusted contractors, and take the first steps toward electrification. This campaign is designed to lift up and align with those efforts, amplifying the innovative work already underway.

''When we first bought our house, the energy bills were jarring. We knew we couldn't afford to keep filling the oil tank. Thanks to the 25C tax credit, we were able to install a far more efficient and affordable heat pump system last winter,'' said Annie Goodenough, a homeowner in Alaska. ''We recommend other first-time homeowners who are looking to lower costs and improve the overall comfort of their home take advantage of the tax credits while they can. Now that we're a little more settled, I'm excited to take advantage of other tax incentives to install more insulation ahead of winter so our home will be even more efficient!''

''I've been doing HVAC installations for the past 40 years, and I can tell you that I've seen firsthand how the 25C tax credit has made heat pumps, the most efficient HVAC technology, more affordable and accessible for homeowners. It drove so much business that I was able to form my whole company, Royal River Heat Pumps, around installing just that appliance,'' said Scotty Libby, owner of Maine-based Royal River Heat Pumps. ''Homeowners should talk to their local contractors now if they want to upgrade their HVAC, take advantage of the tax credit, and lock in the potential long-term energy savings a heat pump would provide.''

''High energy bills are squeezing families across America, and they need practical solutions now,'' said Rep. Kathy Castor. ''These federal tax credits have helped households save money and upgrade to modern appliances that cut monthly bills and improve comfort. I applaud Rewiring America for helping families act before these critical credits vanish. I am not giving up on helping Americans save money and protect their homes.''

''These clean energy tax credits have helped American families and businesses save money, and now is the time to take full advantage of them,'' said Climate Mayors chair Phoenix Mayor Kate Gallego. ''We have a narrow window to get the word out and help our communities benefit from these proven, popular credits which are making clean energy more affordable and accessible across the country.''

''Federal tax credits often make electrification more accessible for many families and give contractors another tool to help projects pencil out economically,'' said Dave Boettcher, CEO of Massachusetts-based Abode Energy Management. ''Right now is a critical window to educate families and contractors about the benefits of tax credits before they disappear. It's important that families know they need to find a qualified contractor soon to get their project installed before

the end of the year and start realizing the benefits of cleaner, healthier, more comfortable heating and cooling.''

''We're already seeing a surge in demand as homeowners rush to lock in the 25C and 25D incentives before they disappear. Households that want to take advantage should act now — once they're gone, they're gone,'' said DR Richardson, co-founder of Elephant Energy. ''But the need for affordable, efficient electric homes won't go away in 2026, and at Elephant, we're making electrification simple and cost-effective for the long run.''

''Tax credits may expire, but the benefits of better HVAC — lower bills, healthier homes, and lasting comfort — are here to stay. That's why we're supporting Rewiring America's campaign,'' said Bill Spohn, Sr., President, The Better HVAC Alliance.

''Heat pumps represent the future of home comfort – they're incredibly efficient, delivering up to 400% efficiency while providing both heating and cooling in one elegant system,'' said Paul Lambert, CEO of Quilt. ''The 25C tax credit has been instrumental in helping homeowners discover just how transformative this technology can be. We've created a new resource and neighborhood awareness campaign to ensure as many families as possible can experience the magic of heat pumps before these valuable federal incentives expire at year's end.''

''Even as we continue the fight to restore these tax credits, contractors have a golden opportunity to help their customers upgrade to more efficient equipment and more comprehensive home upgrades,'' said Sean Robertson, vice president of membership, advocacy, and events at Air Conditioning Contractors of America. ''Smart contractors can use Rewiring America's tools and the urgency of a year-end deadline to get customers off the fence, driving premium business through the shoulder season.''

''Insulation is one of the most cost-effective ways to improve home energy performance — and one of the easiest upgrades to complete before the 25C tax credit expires,'' said Jonathan Belanus, President of the Insulation Contractors Association of America. ''Rewiring America's campaign will help homeowners understand their options, find qualified contractors, and act before valuable tax credits expire. These are the kinds of resources families need to improve comfort and cut waste, especially before winter hits.''

''Rewiring America's timely campaign will help families facing skyrocketing utility bills access safe, clean energy appliances,'' said Lisa Hoyos, LCV Senior Director for Climate and Clean Energy. ''Affordable rooftop solar and heat pumps are game changers for every community — cutting costs for households and reducing dependence on fossil fuels.''

''Our governors are committed to spreading the word on how consumers can lower their energy bills through these expiring tax credits, and we welcome this effort from Rewiring America,'' said U.S. Climate Alliance Executive Director Casey Katims. ''The clock is ticking and now is the time for Americans to upgrade to better, cleaner tech and save money.''

''Clean energy tax credits have played a critical role in lowering energy costs, creating jobs, and reducing climate pollution. Our nationwide network of grassroots volunteers will be sharing Rewiring America's resources in their local communities, encouraging homeowners to maximize those benefits before the credits expire,'' said Ricky Bradley, Interim Executive Director of Citizens' Climate Lobby.

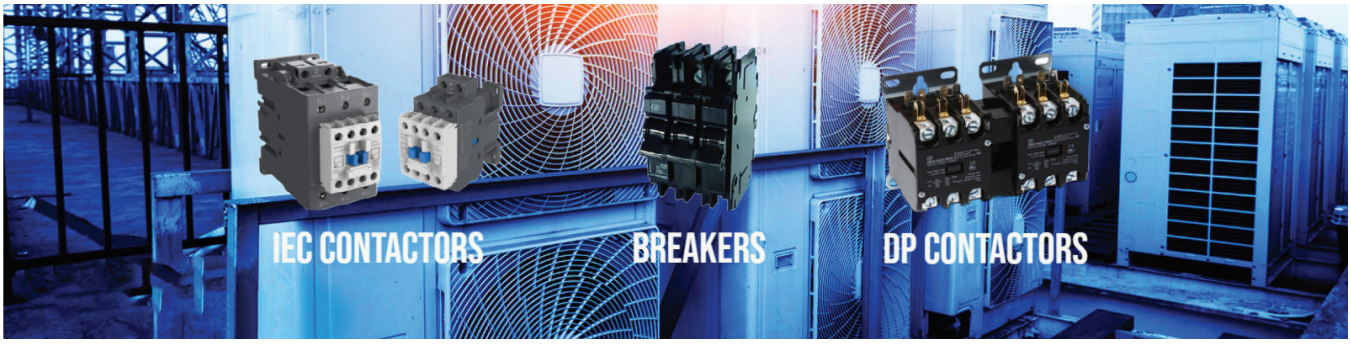
''Going solar helps families save money by taking control of where their energy comes from,'' said Anya Schoolman, Executive Director, Solar United Neighbors. ''A lot of folks are looking to do so before the tax credit expires. We are ready to help guide them so they can go solar with confidence.''

Rewiring America is coordinating with elected officials, private-sector manufacturers, utility program administrators, and grassroots partners to amplify campaign materials in priority states.

Homeowners, contractors, and partners can visit rewiringamerica.org/save to learn more.

Home Connectivity Alliance Announces HCA Energy Management Specification 2.0 and HCA Insurance Specification at IFA 2025 Both specifications are targeted for public release by the end of 2025

Home Connectivity Alliance (HCA), an organization dedicated to the development and promotion of secure



interoperability and energy savings across long-life appliances, HVAC systems and TVs within the connected home ecosystem, today announced the upcoming HCA Energy Management Specification 2.0 and HCA Insurance Specification 1.0 at IFA 2025.

''I am pleased with the progress the Alliance has made in the past year. HCA remains focused on cross-industry collaboration and innovation to help consumers save time and money through connected solutions,'' said Yoon Ho Choi, Home Connectivity Alliance President. ''Our members share a common vision of responsibly and safely utilizing data insights from long-life appliances and HVAC systems to benefit consumers while ensuring their privacy. The HCA Energy Management Specification 2.0 and Insurance Specification will define better energy efficiency from long-life appliances and HVAC systems, cost savings, and additional protection and value for homeowners.''

''Over the past few months, HCA has made meaningful strides in advancing smarter, more sustainable connected homes,'' said Marco Bulgheroni, HCA Board Member and Chief Digital Technology Officer at Electrolux. ''With the launch of Energy Management Specification 2.0, we're not only reinforcing the technical backbone for interoperability – we're also equipping consumers with practical tools to plan, manage, and budget their household energy use more effectively. This is about translating innovation into everyday impact: empowering families to make informed decisions that drive both cost savings and a more sustainable future.''

In 2024, HCA announced the release of HCA Energy Management Interface Specification 1.0 at CES, establishing an industry standard for energy-efficient solutions within the connected home. With HCA Energy Management, key data from appliances that consume the most energy – including how much power they use and how to optimize it – becomes more accessible. Energy usage insights, powered by HCA technology, enable consumers to experience better energy efficiency and real-world cost savings. The 2.0 specification expands HCA Energy Management to include updated cybersecurity features, new configuration options for demand response, and added support for interactions between energy management systems and smart appliances.

''The HCA Energy Management Task Force looks forward to the release of version 2.0 of the Energy Management Specification,'' said Michael Siemann, HCA Energy Management TF Chair and Director of Technology, Resideo Grid Services. ''This update strengthens support for smart appliances in demand response, giving utilities and aggregators clearer tools to enroll, coordinate and manage devices. It also defines a practical framework for energy management systems to monitor and control appliance energy usage.''

The HCA Insurance Task Force was established with a clear mission to develop a data pipeline (API) between connected home equipment and the insurance industry that delivers value to all parties: consumers, connected equipment manufacturers, and the insurers. Rising costs of avoidable residential damages, rapidly increasing insurance premiums, significant consumer deductibles, and even potential scarcity of insurance, has made the intersection of insurance and connected home equipment more relevant to homeowners than ever before.

Publication of the Insurance API v1.0 – enabling a standardized method for HCA members to share relevant data with the insurance industry and therefore foster the development of unique insurance products to benefit smart appliance owners – is the first step in bringing the connected home manufacturing and insurance industries together.

''HSB is exploring and developing solutions that leverage the largely untapped value of IoT technology and data within the connected home ecosystem,'' said John B. Riggs, HCA Board Member and CTO & SVP, Applied Technology Solutions & President, Meshify at HSB. ''We look forward to ongoing collaboration with appliance manufacturers, insurance companies, and property owners to deliver data-enabled products and services that enhance loss mitigation while providing a practical realization of our Connect, Protect & Save vision.''

Additionally, HCA announced the formation of the Korea-SIG (Special Interest Group) dedicated to adoption of HCA specifications. New adopter members include Hyundai Development Company (HDC), HDC Labs, Hyundai Engineering and Construction, Hyundai HT Co., S-1 Corporation, and Sqisoft Inc. HCA Korea-SIG will work closely with KASH (Korea Association of AI Smart Home) to leverage HCA



specification for the various industries that are part of SIG.

"The benefit for HCA adopters is once they have integrated with one of our members, connecting to other members can be as simple as changing the URLs and security keys," said John Hughes, HCA Technical WG Chair and Chief Engineer, Trane Technologies. "This scalability opens up business opportunities that might not exist for one-on-one partnerships. Plus, by working together, we are designing solutions that are better than any of us could design alone."

To learn more about HCA membership benefits or to become a member, visit www.homeconnectivityalliance.org/membership.

Member Company Supporting Quotes

"At HCA, we are uniting industry leaders to define a common data model that enables true interoperability across brands and ecosystems. With the Energy Management and Insurance specifications, we're not just creating standards – we're building a foundation for smarter, safer, and more sustainable homes. Cloud-to-cloud integration is key to unlocking this potential at scale." ~ Stefano Toppan, HCA Data Model TF Chair and Data Model Senior Engineer at Electrolux

"At HSB, we see clear opportunity in connected home solutions that help homeowners avoid costly losses. With the launch of the HCA Insurance API 1.0, data from connected appliances can now power smarter protections and services – matching consumers with insurers who reward their investment through meaningful savings, new products, and even enhanced safety and conveniences." ~ Louis 'Jed' Usich III, HCA Insurance TF Chair and Senior Vice President Strategic Growth Solutions Portfolio Risk Solutions, HSB

"Vestel is proud to be a member of the Home Connectivity Alliance. Through this alliance, we strengthen our commitment to delivering a seamless smart home experience by working alongside the world's leading manufacturers and service providers to ensure interoperability and shared value. In addition, HCA's initiatives in areas such as energy management and insurance provide significant benefits for consumers, supporting both sustainability and safety within the ecosystem. Looking ahead, Vestel will continue to contribute actively under the HCA framework, focusing on delivering comprehensive, simple, and secure solutions for users. Our goal is to make smart home technologies more accessible while enabling a reliable and future-ready connected living experience for households worldwide." ~ Direnc Demir, HCA Board Member



GE Appliances shifts more production to US as part of a $3 billion investmentt

GE Appliances plans to shift production of refrigerators, gas ranges and water heaters out of China and Mexico as part of a more than $3 billion investment to expand its U.S. operations in Kentucky, Georgia, Alabama, Tennessee and South Carolina.

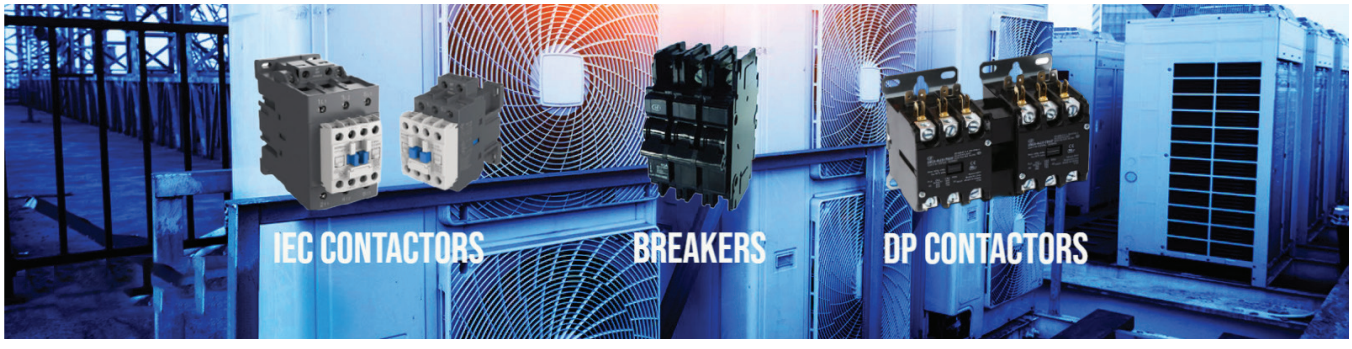
The investment — the second-largest in the Louisville-based company's history — is expected to add more than 1,000 jobs while ramping up domestic production and modernizing plants in the next five years.

"Our long-term strategy is about manufacturing close to our customers," said CEO Kevin Nolan. "With lean manufacturing, upskilling our workforce and automation, the math works for manufacturing in the United States."

The majority of GE Appliances' production is already in the U.S. and the shift means only that the company will transfer more work to its domestic plants.

GE Appliances will relocate production of gas ranges from Mexico to a plant in Georgia, while six refrigerator models now made in China will be manufactured at its Alabama plant, the company said.

In June, the company said it would move production of clothes washers from China to its sprawling



manufacturing complex in Louisville. The reshoring announcements come as President Donald Trump tries to lure factories back to the United States by imposing import taxes — tariffs — on foreign goods.

GE Appliances said Wednesday that the first phase of its new investment will begin at plants in five Southern states — Kentucky, Alabama, Georgia, Tennessee and South Carolina.

''We are defining the future of manufacturing at GE Appliances by investing in our plants, people and communities,'' Nolan said. ''No other appliance company over the last decade has invested more in U.S. manufacturing than we have, and our $3 billion, five-year plan shows that our commitment to U.S. manufacturing will continue into the future.''

The multiyear plan includes ramping up production of gas ranges that have been made in Mexico but will shift to the company's plant in LaFayette, Georgia, the company said. Production of six refrigerators now made in China will move to its plant in Decatur, Alabama.

The GE Appliances plant in Camden, South Carolina, will add production of electric and hybrid heat pump water heaters, doubling the factory's output and employment once the project is complete, the company said. The plant now produces gas water heaters. Production of the company's electric and hybrid water heaters — now made in China — will shift to South Carolina.

In Selmer, Tennessee, its plant will produce two new models of air conditioners.

The latest investment includes the June announcement that GE Appliances will pump $490 million into its Kentucky complex to produce a combo washer/dryer and a lineup of front load washers that are now made in China. In all, production of more than 15 models of front load washers will shift to the company's Louisville complex — known as Appliance Park, it said.

Once its new plan is fully implemented, GE Appliances will have invested $6.5 billion across its 11 U.S. manufacturing plants and nationwide distribution network since 2016, it said.

Kentucky Gov. Andy Beshear said Wednesday that the investment shows his state's ability to support world-class companies with a skilled workforce and the resources needed to thrive.

''GE Appliances has established Kentucky as America's destination for advanced manufacturing and job creation, and today's news shows this iconic company's unwavering belief in the commonwealth and the role we play in their success,'' Beshear said.

GE Appliances handles product design and engineering work at its Louisville headquarters but doesn't make all of its products in the U.S. It contracts with other manufacturers, including in China, for some of its production where it doesn't have capacity or needs access to a global supply chain. The company said its core business strategy is to base production in the United States, and investments announced in June and on Wednesday are another step toward achieving that goal.

The company said it's partnering with universities, technical schools and high schools to help ensure that its plants and other facilities have a trained workforce.

''Infrastructure and tools matter, but they are not enough,'' said Bill Good, vice president of supply chain for GE Appliances. ''America's manufacturing renaissance will be built by people.''

GE Appliances is a subsidiary of the China-based Haier company.

Overall, GE Appliances says it contributes more than $30 billion annually to the U.S. economy and supports more than 113,000 jobs – both directly and indirectly – through its operations, suppliers and distribution network.

ATP Launches North America Business with Manufacturing Facility in South Carolina

ATP Adhesives announced the launch of ATP North America, establishing a dedicated business to serve U.S and Canadian manufacturers with solvent-free adhesive technologies and local product-development capabilities. As part of this expansion, ATP will invest $70 million in its first solvent free U.S. manufacturing facility in Columbia, South Carolina. The 127,000-square-foot plant will create 130 jobs and begin production in July 2026.

''Establishing the ATP North America business and building our first U.S. manufacturing facility is a strategic move to accelerate ATP's growth in the United States,'' said Dirk Henke, managing director and newly appointed U.S. leader of ATP North America. ''ATP is



recognized across Europe and Asia for delivering high-performance, solvent-free adhesive tapes. By pairing ATP's German and Swiss engineering heritage — advanced coating know-how and process discipline — with American manufacturing in West Columbia, South Carolina, we'll offer shorter lead times, a more secure supply chain, and local collaboration from trials to scale using solvent-free adhesive systems.''

ATP will help manufacturers to achieve cost savings by providing the right solvent-free tapes for their applications, made in the United States, while improving sustainability and simplifying sourcing. The company reports that locating closer to the point of use enables faster turnaround, tighter collaboration on new applications, and inventory strategies that can better align with real demand.

''Launching ATP North America and building our first U.S. solvent free facility is a major milestone in the company's global growth story,'' said Daniel Heini, CEO of ATP Adhesives. ''ATP is recognized across Europe and Asia for delivering high-performance, solvent-free adhesive tapes. With a North American hub and manufacturing in Columbia, we will bring that same innovation and reliability closer to customers in the U.S.''

The new facility benefits customers by providing ATP's global expertise on a local level, faster collaboration due to local product development capabilities, and a secure supply chain due to the local onshore capacity and strategic location in Columbia, South Carolina.



Rheem® Celebrates a Century of Excellence, Partnership and Possibilities

Atlanta-based Manufacturer of Water Heating and HVAC/R Products Commemorates 100 Years of Innovation

Rheem®, a leading manufacturer and household name in the water heating and HVAC/R industry, kicked off the New Year with the launch of its 100th anniversary celebration—a major milestone reflecting a century of excellence, innovation, and ingenuity. Rheem attributes its legacy of success to the company's nearly 14,000 dedicated employees, its unwavering commitment to customers and industry partners, and an entrepreneurial drive that has made the company a global leader in the marketplace. Events to honor the centennial will run through 2025.

Rheem® Celebrates a Century of Excellence, Partnership and Possibilities

''As we celebrate Rheem's 100th anniversary, we reflect on the incredible journey that has brought us to this moment – a journey fueled by innovation, dedication, and the strong relationships we've built with our customers, partners, and employees. From the early aspirations of our founders through our evolution as a global leader in sustainable water heating and HVAC/R solutions, Rheem's success is a direct result of the values that have guided us for nearly a century,'' said Chris Peel, CEO, Rheem. ''As we look to the future, we are excited about the contributions we will make to help shape the next 100 years of progress in our industry to build on Rheem's legacy.''

Rheem's rich history dates back to 1925 when the Rheem brothers—Richard and Donald—founded the company in California to manufacture steel drums, barrels and other metal products in a plant that became renowned for its cutting-edge technology. One innovation led to the next until the company became synonymous in the industry with breakthrough solutions and technological advancement. Now, one hundred years later, the company is known for being at the forefront of heating, cooling and water heating solutions.

Rheem has planned celebrations around the globe to commemorate its centennial with milestone events such as the sealing of a historic time capsule filled with memorabilia that is slated to be opened in 2050. Rheem's newly launched anniversary microsite Rheem.com/100 will capture Rheem's 100 years of innovation. Visitors will be able to glean insight into Rheem's history by way of vintage advertising, videos, and a showcase of past and current product innovations

Avery Dennison Announces New VP and General Manager of Materials Group EMENA



Avery Dennison Corp. recently announced the promotion of Mariana Rodriguez to vice president and general manager for Materials Group EMENA. Rodriguez is now responsible for implementing growth strategies for Materials Group EMENA, meeting its short- and long-term business, financial, and operating objectives, and identifying and cultivating new revenue streams.

Rodriguez commented, ''Avery Dennison sees huge potential for growth in the EMENA region, and we are positioned to capitalize on opportunities here because we have the knowledge, experience, equipment and spirit of innovation needed to succeed.

''We continue to push boundaries in labels and packaging — including the solutions we will be showcasing at Labelexpo 2025 in Barcelona that drive circularity, enable traceability and enhance consumer experiences.''

Rodriguez added, ''Materials Group EMENA is known for its materials science expertise and dedication to customer satisfaction. I will be leveraging our talented teams' collective strength to achieve our goals for sustainable growth and profitability, while continuously improving our customer experience and collaborating together to innovate.''

Rodriguez has worked at Avery Dennison since 2006,

holding leadership roles across multiple Materials Group regions. Her experience spans the Label and Packaging Materials, Graphics Solutions and Performance Tapes businesses, where she has served in supply chain, procurement, marketing and general management. Most recently, she was vice president and general manager of Performance Tapes, Europe, and vice president and general manager of Graphic Solutions, North America.

Radiative "Sunscreen" Coating Targets Urban Cooling

A new thermal insulation coating system which can cool down buildings and make them more energy efficient has been launched by AkzoNobel in China.

Featuring a radiative cooling topcoat and a thermal radiation barrier midcoat, the innovative technology from the company's Decorative Paints business acts like a sunscreen. It means the surface temperature of buildings can be lowered by up to 10% during hot summer months compared with using conventional coatings.*

The passive radiative cooling process the system uses involves emitting heat lost through thermal radiation into outer space. It's expected to significantly enhance energy-saving performance—particularly when renovating existing buildings—and has been successfully tested on several buildings in the Lingang section of the Shanghai Pilot Free Trade Zone.

"This is a significant breakthrough in architectural coatings and opens up new avenues for energy-efficient building renovations," says Karen Yin, director of the company's Decorative Paints China North Asia business and president of AkzoNobel China. "We aim to provide consumers with safer, more sustainable and comfortable living environments while contributing to China's dual-carbon policy, which is focused on both controlling total carbon emissions and carbon emissions intensity."

The midcoat uses advanced aerogel insulation materials, which have extremely low thermal conductivity, helping to effectively block the transmission and penetration of heat. The topcoat is an upgraded version of heat-reflective coatings, offering higher reflectivity to further reduce solar heat absorption. It also has high thermal emittance, allowing it to directly emit heat back into the atmosphere, mitigating urban heat island effects. Both of these coatings are low-VOC and fully water-based.

Adds Yin: "The science behind these 'cool coatings' might be complex, but the effect is easily explained. A 'normal' exterior coating will heat up in the sun because it still absorbs some sunlight. A heat-reflective coating will heat up less because it absorbs less sunlight. Our new cool coatings don't heat up at all because they barely absorb any sunlight and efficiently radiate the heat away."

With the built environment estimated to be responsible for around 40% of annual global carbon emissions, the technology has the potential to redefine urban cooling in hot climates and help drive the creation of more sustainable buildings.

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EU Compliance:

New Cybersecurity EN 18031-X:2024 Standards for Radio Equipment Directive (RED)



New regulatory developments for manufacturers of devices and systems that include radio or wireless enabled equipment (host devices) include newly ratified standards that address cybersecurity requirements that are mandatory starting August 1, 2025. The European Commission has officially listed the EN 18031-X:2024 series in the Official Journal (OJ) of the European Union under the Radio Equipment Directive (RED), 2014/53/EU. This applies to products that use WI-FI, Bluetooth, Zigbee, and other wireless technologies or protocols, including radio devices that do not connect to the internet.

Equipment that has access or is used with the Internet of Things (IoT) must meet the requirement that will include formal cybersecurity compliance on equipment. This includes household and similar appliances and other equipment that can be programmed or operated via internet commands from users' cell phones or other wireless devices, or associated applications that are involved with processing financial payments or access to virtual money or those items of monetary value.

While most equipment uses pre-approved wireless modules, and many wireless module manufacturers provide updated security protocols, it is the sole responsibility of the company placing the final products into the marketplace to ensure compliance for those end host products for these new cybersecurity requirements. Be aware that the security of the preapproved module is only a minor portion of the cybersecurity requirements for a product using that preapproved module. It is very important to determine the levels of security required for the equipment's intended usage when compared to the wireless modules. The use of independent evaluation and testing organizations can provide needed guidance and support with the detailed review and confirmation of compliance.

EN 18031-X and the Radio Equipment Directive (RED) Cybersecurity Requirements

Radio and wireless IoT integrated equipment placed into the EU market must meet the Radio Equipment Directive, including essential requirements related to safety, electromagnetic compatibility, and efficient spectrum use. The EU Commission introduced cybersecurity requirements in the Deregulated Regulation 2022/30, under Article 3(3):

- Article 3(3)(d): Protection against network harm and service degradation
- Article 3(3)(e): Safeguards for personal data and user privacy
- Article 3(3)(f): Measures to prevent fraud in radio equipment handling virtual currency

The EN 18031-X series of harmonized standards provide the specific requirements for manufacturers to demonstrate compliance with these new cybersecurity requirements.

- EN 18031-1:2024 covering article 3.3 (d) Ensures that radio equipment does not harm the network or its functioning nor misuse network resources, thereby causing an unacceptable degradation of service, and



unauthorized access

- EN 18031-2: 2024 covering article 3.3 (e) Safeguarding personal processing data, namely internet connected radio equipment, childcare radio equipment, toys radio equipment and wearable radio equipment using strengthened authentication, encryption, and other controls to prevent unauthorized access or usage.
- EN 18031-3: 2024 covering article 3.3 (f) Addresses risks specific to radio equipment processing virtual money or monetary value, with fraud protection, and prevention of payment system breaches.

Each of these three standards includes details on guidance, evaluation, security mechanisms, documentation, and testing processes and protocol. These standards have substantial overlapping in many areas but have specific requirements in the unique focus of each individual standard. A comparison of the 14 general categories is below:

Mechanisms (requirements)	EN 18031-1	EN 18031-2	EN 18031-3
ACM Access Control Mechanism	X	X	X
AUM Authentication Mechanism	X	X	X
SUM Secure Update Mechanism	X	X	X
SSM Secure Storage Mechanism	X	X	X
SCM Secure Communication Mechanism	X	X	X
RLM Resilience Mechanism	X		
NMM Networking Monitoring Mechanism	X		
TCM Traffic Control Mechanism	X		
LGM Logging Mechanism		X	X
DLM Deletion Mechanism		X	
UNM User Notification Mechanism		X	
CCK Confidential Cryptographic Keys	X	X	X
GEC General Equipment Capabilities	X	X	X
CRY Cryptography	X	X	X

These categories have additional detailed requirements for each section, and careful analysis must be given to address each applicable section and the unique requirements referenced. It may be that more than one standard would be applicable to show compliance.

Restrictions

Manufacturers can now use the EN 18031-X series to claim presumption of conformity with RED's cybersecurity requirements. However, this usage comes with certain restrictions, which must be carefully considered when implementing compliance strategies. Some of these restrictions relate to:

- Sections related to "rationale" and "guidance"
- Consideration and use of passwords
- Parental or guardian access control
- Transfer of monetary value

Action Items for Manufacturers

As the cybersecurity requirements of the Radio Equipment Directive are mandatory beginning August 2025, it is important for manufacturers to align their products with these new requirements. Key steps include:

1. Review the RED scope: Does your product fall under the scope of the cybersecurity requirements of Article 3(3) sections d, e, and f of the RED?

2. Review the new EN 18031-X Series: Understand how these standards apply to your products and any restrictions affecting their intended use. Multiple standards may apply.

3. Conduct a Risk Assessment Analysis: Assess your current cybersecurity measures against EN 18031-X requirements, including a review of a risk analysis, engaging independent third-party assistance if needed. Do not consider wireless module security alone to be sufficient.

4. Determine Compliance Path: Determining the best way to ensure compliance with the new requirements of the RED directive. A third-party analysis and approval often times equates to decreased time to market. In most cases a tailored test plan is developed, with documentation review, software analysis, and functional confirmation testing included.

5. Requirements for Market Readiness: Implement necessary changes in design, testing, and documentation to meet the August 2025 deadline. At a minimum, an updated technical file, updated users guide, and inclusion of the cybersecurity requirements of the RED Directive in the Manufacture's Declaration of Conformity will be required.

6. Establish On Going Cybersecurity Surveillance: Establish a go forward plan to monitor industry requirements and updates to cyber threats in the marketplace. Manufacturers are required to maintain a high level of cyber resilience, as long as products are in the marketplace.

Other Cybersecurity Considerations

As cybersecurity is a global threat, many counties are in the process of developing formal protection regulations. The United States has in process a program called the US Cyber Trust Mark, overseen by the FCC to address IoT accessed smart device protection. Canada

recently passed the Critical Cyber Systems Protection Act which aims to enhance cybersecurity protection. It can be expected that more formalized cybersecurity requirements will be developed on a global basis.

Summary

The publishing of the EN 18031-X series of harmonized standards in the Official Journal provides much-needed clarity for manufacturers navigating RED's cybersecurity requirements for EU compliance.

However, the accompanying restrictions highlight the need for careful evaluation and expert guidance. Independent third-party organizations can assist manufacturers in interpreting these requirements, conducting assessments, verify operating conditions, and ensuring their products meet all regulatory obligations for continued marketplace presence.

Cybersecurity regulatory updates can be found at: http://www.dlsemc.com/cybersecurity-testing.



Jack Black is the business development manager for D.L.S. Electronic Systems, Inc. and has over 30 years of experience in the field of compliance testing and standards development. Jack can be reached at jblack@dlsemc.com.



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Marilyn Sweeney, CEO and one of the founding members of D.L.S., has published several industry related papers. Marilyn be reached at msweeney@dlsemc.com.

Publishers Update** **Continued from page 6

But for years, Mr. Trump has railed against efficiency standards for home appliances. Yet on Capitol Hill, Energy Star has attracted rare bipartisan support, with lawmakers in both parties saying the program lowers energy costs at a time of rising prices nationwide.

"I know that my constituents like knowing what the energy usage is of a particular appliance so that they can factor that into their buying decisions," said Senator Susan Collins, Republican of Maine and chair of the Senate Appropriations Committee. In July, the Senate and House Appropriations Committees bucked Mr. Trump by proposing to provide level funding for the program for the next fiscal year.

The wrangling over Energy Star's fate began last May, when E.P.A. managers announced during an internal staff meeting that the program would grind to a halt.

"The Energy Star program and all the other climate work, outside of what's required by statute, is being de-prioritized and eliminated," a manager told employees during a staff meeting.

The pushback was swift and intense.

A month later a coalition of industry groups wrote in a letter to congressional leaders that they would "strongly support continuation" of the program. The groups represented a range of businesses, including appliance manufacturers, chemical companies, home builders, retail stores and even bakery owners and hot tub distributors.

Appliance manufacturers and retail stores in particular like Energy Star because it helps sales. Around 90 percent of Americans recognize the program's logo and many see it as a trustworthy way to identify efficient products, surveys have shown.

"We're very supportive of the program remaining in the federal government," said Jill Notini, a spokeswoman for the Association of Home Appliance Manufacturers, one of the groups that signed the letter.

Even Home Depot got involved, whose website allows consumers to search for appliances in the category "Eco Friendly: Energy Star,". They made the case to E.P.A. officials for maintaining the program in recent months. That's no small thing, since it's co-founder, the late Bernie Marcus, was a huge Republican donor.

It's this humble editor's opinion that Energy Star is here to stay!

Brad Glazer

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Understanding Harmonics in Modern HVAC Systems: Challenges, Impacts, and Paths to Mitigation

Electrical infrastructure in commercial and industrial buildings has become increasingly complex. As high-efficiency HVAC systems, LED lighting, switching power supplies, and electronically commutated motors become the norm, the electrical behavior of buildings has shifted as well. These modern loads bring undeniable energy and performance advantages, but they also introduce a long-standing challenge that has gained new relevance: harmonics.

For OEM design engineers, harmonics influence everything from motor performance to grid stability and compliance with global power-quality standards. This article explores what harmonics are, why they matter, and how HVAC manufacturers and system designers can mitigate their effects through thoughtful design and modern technology.

What Are Harmonics?

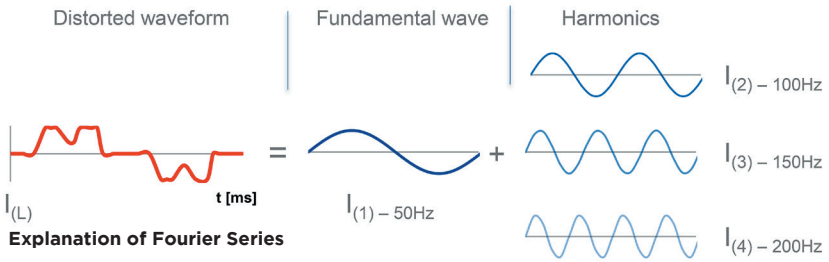
In an ideal scenario, current and voltage waveforms in an AC electrical system follow a perfect sinusoidal shape. However, when devices with power electronics draw current in irregular pulses rather than smooth proportional waves, the resulting distortion creates additional frequency components known as harmonics.

These harmonics occur at integer multiples of the fundamental frequency—60 Hz in North America—meaning a distorted waveform may contain energies at 120 Hz, 180 Hz, 240 Hz, and beyond. Because these frequencies do not contribute to useful mechanical work, they circulate through the electrical network and cause avoidable losses, heating, voltage distortion, and reliability concerns.

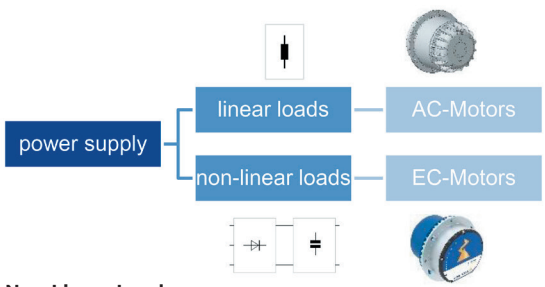


Nonlinear loads that commonly introduce harmonics include:

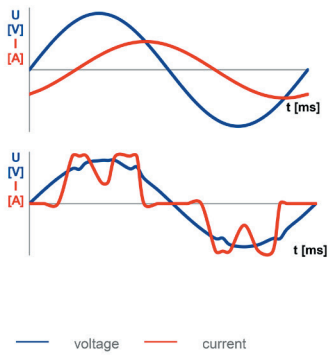
- Variable-frequency drives
- LED drivers
- Switching power supplies
- Data center equipment
- EC motors used in ventilation and cooling
- EV chargers and solar inverters



Explanation of Fourier Series



Non-Linear Loads



With the growing emphasis on energy-efficient HVAC technology, harmonics naturally become a more significant design consideration.

How EC Motors Contribute to Harmonics

Modern HVAC systems widely adopt electronically commutated (EC) motors due to their high efficiency, controllability, and excellent part-load performance. However, the power-electronic stages that enable these benefits also shape the harmonic profile.

Inside a typical EC motor:

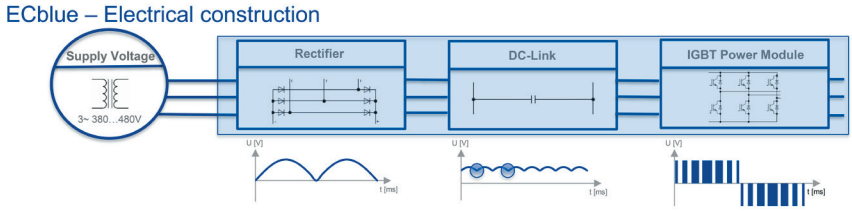
1. A rectifier converts AC input into a pulsating DC waveform.

2. A DC-link capacitor smooths the voltage but also sets a threshold that the incoming AC voltage must exceed before current flows.

3. An IGBT power module switches the DC waveform to create a controlled output frequency that drives the motor.

Because the motor only draws current when the supply voltage rises above the DC-link voltage, the current draw occurs in bursts rather than continuously. This discontinuous behavior produces the harmonic content engineers frequently measure in EC-driven systems.

As building systems increasingly rely on large numbers of EC motors—such as fan arrays, DOAS units, rooftop equipment, and data-center cooling walls—harmonics become a cumulative system-level concern.



Electrical Construction of EC Motors

Why Harmonics Matter in HVAC Environments

Thermal Stress and Reduced Lifespan

Harmonic currents increase RMS current, which directly increases I^2R losses in cables, transformers, breakers, and motor windings. Over time, this extra heating reduces service life and may lead to premature failures of components that were not designed to handle the additional thermal load.

Voltage Distortion and Resonance

Harmonic currents interact with system impedances, sometimes aligning with resonant points in the electrical network. This can amplify distortion levels and create:

- Nuisance trips
- Overcurrent conditions
- Unstable operating states for motors and drives

These risks grow significantly in facilities with large and changing nonlinear loads.

Impact on Controls and Sensitive Devices

Modern HVAC systems depend on digital controls, communication buses, and sensitive electronics. Harmonics introduce noise into these systems, which may cause:

- False alarms
- Sensor errors
- Misfiring of protective relays
- Communication interference

In mission-critical facilities, even momentary disturbances can translate to costly downtime.

Inefficient Power Use and Utility Penalties

Harmonics introduce distortion reactive power, which cannot be corrected with traditional capacitor banks. This lowers the true power factor and increases distribution losses, sometimes triggering utility penalties or requiring expensive corrective infrastructure.

System-Level Compliance

Standards such as IEC 61000-3-2 for equipment-level limits and IEEE 519 for site-level distortion place increasing emphasis on harmonic management. HVAC equipment must now integrate seamlessly into environments where power quality is tightly regulated.

Measuring and Predicting Harmonics

Engineers use two main approaches:

Direct Measurement

Power analyzers equipped with FFT algorithms record waveform data and quantify:

- Total Harmonic Distortion (THD-I and THD-U)
- Individual harmonic amplitudes
- Harmonic spectra across operating conditions

These measurements are essential during commissioning and troubleshooting.

Analytical Modeling and Simulation

Network modeling tools help engineers predict harmonic behavior in complex systems and explore the effects of adding motors, drives, or filtering solutions before installation.

Mitigating Harmonics in Real-World HVAC Systems

Harmonics can be addressed through a combination of **better equipment design, integrated mitigation technologies,** and **system-level filtering strategies.** Ziehl-Abegg incorporates harmonic reduction into multiple aspects of its product portfolio, helping engineers simplify compliance and improve system efficiency in an organic,

embedded way.

1. Low-Distortion EC Motor Design

Ziehl-Abegg's ECblue platform uses an optimized internal rectifier and DC-link architecture designed to reduce harmonic content at the source. Control algorithms modulate switching behavior to produce smoother current draw, reducing the need for downstream corrective components.

Next-generation ECblue motors incorporate integrated power-factor-correction (PFC) technology available up to 6 kW. By achieving:

- power factor up to 0.99, and
- significantly lower distortion reactive power,

these motors allow engineers to deploy high-efficiency fans in greater quantities without overwhelming a site's electrical infrastructure. Because mitigation happens inside the motor, system engineering becomes simpler, especially in dense installations like fan walls or data center cooling modules.

2. Optional Active Harmonic Filters

For applications where load profiles fluctuate or where extremely sensitive electronics are present, Ziehl-Abegg offers compact active harmonic filters that work dynamically.

These filters:

- Continuously measure harmonics
- Inject compensating currents in real time
- Improve power factor and balance phases
- Require no complex commissioning
- Fit into standard control panels without excessive heat generation

Available in multiple current ratings, these filters give OEMs and facility engineers flexible mitigation options when system conditions are unpredictable or when regulatory limits tighten.

3. Engineering Support and Application Guidance

In addition to products, Ziehl-Abegg supports OEMs and consulting engineers with:

- Application-specific harmonic analysis
- Power-quality recommendations for fan arrays and large EC deployments
- Guidance on meeting IEEE and IEC requirements
- Training on harmonic behavior and mitigation technologies

This ensures that harmonic mitigation is considered early in the design process, reducing the likelihood of costly redesigns or retrofits later.

The Future of Harmonics in HVAC

As electrification grows, so will the number of nonlinear loads on the grid. HVAC systems alone represent a significant share of the nonlinear load profile in many commercial buildings, making harmonics a critical engineering focus.

The good news is that mitigation is increasingly being built directly into the equipment. Integrated PFC architectures, compact active filters, and smarter control technologies are paving the way for HVAC solutions that both **perform efficiently** and **protect power quality.**

As you evaluate next-generation fan and motor technologies—or design systems that depend on them—you will see harmonic mitigation shift from an added consideration to a core function of modern HVAC components.

To explore these technologies firsthand, including the newest high-efficiency, low-distortion fan systems, visit **Ziehl-Abegg at Booth C5329 during the AHR Expo in Las Vegas February 2-4, 2026.**



By Cristian Chavez, Ziehl-Abegg



Expansion of A2L-Driven Systems Shows Continued Growth of Solution

The industry-wide migration toward A2L refrigerants - driven by evolving environmental regulations – has made a wide variety of impacts across the global HVAC industry.

Verticals outside of traditional building cooling – such as commercial and transport refrigeration and data center cooling - are about to shift to A2L frameworks. And those shifts toward A2L have also introduced new thermal and safety considerations into HVAC/R system design.

Data center expansion driving cooling growth

With the rapid expansion of AI and other computing-intensive systems, demand for data center infrastructure has scaled exponentially in recent years. Those growth initiatives are also balanced by a continued emphasis on energy efficiency and reducing consumption - particularly in thermal management systems, which represent a significant portion of total power draw. These new systems are leveraging A2L refrigerants to meet global climate change regulations.

Integrating A2L refrigerants into data center cooling infrastructure-particularly in CRAC (Computer Room Air Conditioning) and CRAH (Computer Room Air Handling) systems - necessitates a comprehensive redesign of safetycritical components. Chief among these is the implementation of advanced leak detection systems capable of operating reliably in high-humidity, thermally dynamic environments.

Smaller commercial refrigeration systems leveraging A2L

Commercial refrigeration systems often rely on high-capacity compressors to accommodate the extreme pressures required by CO2-based refrigerant loops, which can reach up to 150 bar (≈2100 psi). While CO2 offers low global warming potential (GWP), its high operating pressure necessitates robust mechanical design and specialized components, making it less viable for compact systems such as those used in convenience stores.

Ammonia (NH3) remains another alternative due to its excellent thermodynamic efficiency and zero GWP. However, its toxicity and stringent safety requirements limit its applicability in consumer-facing or mobile refrigeration platforms.

To comply with safety standards such as UL60335-2-40, A2L-based systems require integrated leak detection mechanisms. Sensor placement and performance are critical, particularly near the evaporator coil, which is an area prone to refrigerant leakage due to thermal cycling, condensation, and mechanical stress.

Moreover, the mobile nature of commercial refrigeration units - often relocated across retail environments - introduces variability in ambient conditions and airflow patterns, further complicating sensor calibration and reliability. Engineers must account for these dynamic factors when designing leak detection systems, ensuring robust performance across a range of operating environments while maintaining compliance and minimizing false positives.

Transport refrigeration shows expansion of A2L ecosystem

Refrigerated transport solutions are a vital component of the logistics world, reducing food waste and keeping other goods such as refrigerated medical supplies safe during shipment. These transport solutions rely on special temperature-controlled vehicles such as trucks, ships, and containers, equipped with built-in refrigeration systems that maintain cooling throughout the entire journey.

Transport refrigeration systems require precise temperature control and constant monitoring to operate their complex thermal cycles with cargo integrity and regulatory compliance. As the industry adopts low global warming potential (GWP) refrigerants for environmentally responsible operations, performance expectations on electronics within the system continue to rise.

Unlike household refrigerators, transport refrigeration systems must be built to withstand vibration, environmental extremes, and power fluctuations. The demanding environment poses a risk of impacting critical monitoring

and control systems. Failures may result in product spoilage, financial loss, and safety risks.

To meet environmental demands and rising performance expectations, transport refrigeration systems need electronic components they can rely on, with accurate monitoring and control under rugged operating conditions.

Gas detection sensors compatible with A2L refrigerants are an ideal solution for the recent adoption of low global warming potential refrigerants. By constantly monitoring the acoustic resonance of the surrounding air, the Sensata ResonixTM RGD leak detection sensor can detect even low-level leaks of mildly flammable A2L gases, supporting safety and environmental objectives. The sensor has also been tested in a wide array of conditions, including high vibration situations, and acidic salt fog envionments to ensure corrosion resistance.

Thermal drift and system-level impacts in A2L-based hvac architectures

The transition to A2L refrigerants has necessitated a reevaluation of pressure and temperature thresholds across HVAC system designs. These mildly flammable refrigerants typically operate at elevated discharge temperatures, which can exacerbate thermal drift, particularly in high-side pressure sensing and control components.

High-pressure cutoff switches, which are essential for maintaining operational safety and compliance with regulatory standards (e.g., UL, IEC), are especially susceptible. Excessive thermal drift can lead to premature or delayed actuation, undermining system reliability and increasing the risk of false trips or failure to engage under fault conditions.

This challenge is compounded by the growing emphasis on energy efficiency as a market differentiator. Erroneous pressure readings due to thermal instability can disrupt control logic, preventing optimal modulation of compressors, fans, and pumps. The result is suboptimal system performance, elevated energy consumption, and increased operational costs due to unnecessary cycling or maintenance interventions.

Precision in thermal management is particularly critical in applications requiring tight environmental control (e.g., data centers, pharmaceutical storage, or process cooling). In these contexts, low-drift pressure sensors and integrated smart control systems are essential. Enhanced thermal stability ensures accurate real-time data acquisition, enabling more responsive and intelligent system behavior through advanced control algorithms.

Looking ahead in A2L system developments

As A2L and A3 refrigerant-based HVAC systems continue to proliferate across global markets and diversify into new verticals, it is increasingly evident that this transition marks the beginning of a sustained period of iterative design refinement rather than a singular market shift. The evolving regulatory landscape and refrigerant characteristics are driving continuous innovation in system architecture, component integration, and control strategies.

HVAC systems remain a focal point in global energy reduction initiatives, given their substantial contribution to commercial building energy consumption - typically ranging from 40% to 60% of total usage. This positions HVAC platforms as a primary target for efficiency gains and carbon footprint reduction.

The adoption of new refrigerants introduces shifts in thermal operating conditions, necessitating a reevaluation of system components such as compressors, expansion valves, sensors, and control logic. Engineers must assess the downstream effects of altered temperature profiles to ensure that system performance remains within optimal parameters. This includes maintaining thermal stability, minimizing drift in sensing elements, and ensuring compatibility with smart control systems designed to maximize energy efficiency.

The next phase of HVAC innovation will be characterized by adaptive design methodologies, where component selection and system calibration are continuously refined to meet the dual demands of regulatory compliance and high-efficiency operation.

by Sensata



The Future of Cold Storage:

Innovations in Energy Efficiency



Why Energy Efficiency Matters Now More Than Ever

In an era marked by rising energy costs, shifting regulations, and a growing demand for sustainable business practices, the cold storage industry stands at the crossroads of innovation and necessity. Energy efficiency is no longer a bonus—it's a mandate. For businesses that rely on walk-in coolers and freezers, from restaurants and grocery stores to pharmaceutical labs and food distribution centers, future-ready refrigeration means embracing smarter, greener, and more efficient technologies.

Cold storage is an energy-intensive necessity. With compressors running 24/7 and temperature consistency being critical to product integrity, refrigeration systems account for a substantial portion of operational energy use. As utility rates continue to rise and environmental standards become more stringent, operators must find solutions that reduce energy consumption without sacrificing performance.

Fortunately, today's innovations are redefining what's possible. By investing in cutting-edge insulation, intelligent controls, and renewable energy integration, businesses can dramatically cut costs and carbon footprints—while gaining long-term peace of mind.

Insulation: The Unsung Hero of Efficiency

At the heart of every energy-efficient walk-in lies effective insulation. Think of insulation as the first line of defense against energy loss. Traditional polyurethane foamed-in-place (FIP) panels, still widely used across the industry, degrade over time and are prone to absorbing moisture. Refrigeration systems have to work harder to compensate for thermal leakage, leading to higher energy usage.



Enter next-generation materials like extruded polystyrene (XPS) and vacuum insulated panels (VIPs). XPS insulation offers exceptional thermal resistance, moisture resistance, and long-term durability, maintaining its performance over decades. Vacuum insulated panels take benefits a step further—offering five to ten times the thermal efficiency of conventional materials in ultra-thin panels. These high-performance solutions extend compressor life and help reduce energy bills year after year.

Smart Temperature Control Systems: Intelligence Meets Efficiency

Traditional refrigeration systems often run on fixed cycles regardless of demand, leading to wasted energy and excessive wear. Smart temperature control systems change the game. Leveraging IoT-enabled sensors, these systems dynamically adjust cooling operations based on real-time factors such as usage patterns, ambient conditions, and storage loads. Additionally, this real-time data tracking allows operators to fine-tune performance, ensuring optimal temperature with minimal energy waste.

This level of control doesn't solely improve efficiency—it enhances reliability. Predictive maintenance alerts, automated system adjustments, and remote monitoring capabilities provide a layer of transparency and control that was previously unattainable.

Manufacturing Efficiency: Built Right from the Start

Energy efficiency isn't achieved solely through the finished product—it begins on the factory floor. Advanced manufacturing facilities are increasingly turning to automation to improve precision, reduce material waste, and ensure airtight seals that prevent thermal leaks. In-house, CNC-milled panel production ensures tight tolerances and perfect fits, further supporting a cooler's energy integrity.

The efficiency of a cooler is measured by more than the energy it saves during use; how little energy and material are wasted in its production are also

taken into consideration. Efficient manufacturing practices contribute to both lower costs and reduced environmental impact.

Cold storage manufacturers are also investing in emerging technologies that are redefining cooling. Phase change materials (PCMs), for instance, store and release thermal energy as they transition between solid and liquid states. This stabilizes interior temperatures and reduces compressor cycling. Integrated solar refrigeration systems are also gaining traction, especially in regions with high sunlight exposure, offering a renewable path for power hungry equipment.

Mobility is also evolving. Portable refrigeration units like modular, hybrid walk-ins now feature streamlined refrigeration components, integrated thresholds to minimize thermal exchange, and energy-saving construction materials—bringing efficiency to job sites and pop-up operations that require rapid deployment and relocation.

Incentives & Payback: Making the Switch Worthwhile

A common misconception is that energy-efficient cold storage costs significantly more upfront. While advanced components may carry a slightly higher initial price tag, the return on investment is clear. Lower utility bills, fewer maintenance calls, and longer-lasting performance contribute to substantial savings over time.

Government incentives also work to sweeten the deal. Energy Star-certified equipment can qualify for federal and state rebates, tax credits, and grants—offsetting the initial costs and speeding up payback periods. Businesses investing in energy efficiency can now quantify and capitalize on their choices.

Future Outlook: Sustainability Meets Smart Technology

Beyond compliance and cost savings, energy-efficient cold storage offers a competitive edge. Businesses that invest in sustainable infrastructure demonstrate long-term thinking, environmental stewardship, and operational excellence—traits that resonate with both consumers and stakeholders alike.

In high-demand industries like foodservice, pharmaceuticals, and hospitality, a reliable and energy-efficient refrigeration system can be the difference between business continuity and costly downtime. It's not just about cold storage—it's about business resilience.



The next frontier in cold storage lies at the intersection of sustainability and smart technology. Innovative manufacturers, such as Amerikooler, a global leader in commercial refrigeration solutions, are already investing in AI-driven cooling algorithms, adaptive energy optimization, and advanced insulation materials to create systems that are not only more efficient, but also more responsive to changing operational needs. For example, innovations like Amerikooler's FlexiCool ProBox demonstrate how energy efficiency, portability, and rapid deployment can be combined to meet evolving operational challenges—offering scalable solutions that support sustainable growth across diverse sectors. By prioritizing innovation and continuous improvement, these industry leaders are helping to set new benchmarks for reliability, sustainability, and business resilience.

Sustainability isn't just about meeting regulations—it's about future-proofing business models. As cold storage evolves, those who embrace energy-efficient practices today will be better positioned to thrive tomorrow

Embracing Innovation for a Sustainable Cold Storage Future

As the cold storage industry faces increasing pressures from rising energy costs, regulatory demands, and sustainability goals, the imperative to adopt energy-efficient technologies has never been clearer. Innovations in advanced insulation materials, smart temperature control systems, and manufacturing precision are transforming how businesses manage refrigeration—delivering not only cost savings but also enhanced reliability and environmental responsibility.

Looking ahead, the integration of intelligent controls and renewable energy solutions will continue to redefine industry standards, enabling cold storage operators to optimize performance while minimizing their carbon footprint. These advancements represent a fundamental shift toward smarter, more resilient cold storage infrastructure that supports long-term business continuity and growth.

For organizations across foodservice, healthcare, retail, and industrial sectors, investing in energy-efficient cold storage solutions is a strategic decision that aligns operational excellence with sustainability commitments. By embracing these innovations today, businesses position themselves to meet tomorrow's challenges with confidence and agility—setting a new benchmark for what cold storage can achieve in an evolving marketplace.

By: Gian Carlo Alonso, President & CEO, Amerikooler

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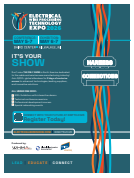
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