OCTOBER 2013 VOL. 11 NO. 8

Commercial BUILDING PRODUCTS

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View Walls As Systems

Emergency Lights A Priority

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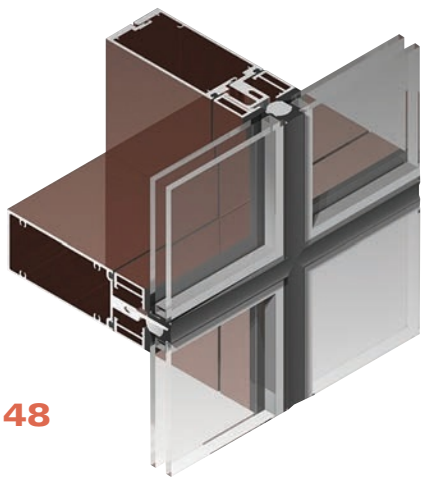

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About The Cover

Old buildings, such as the Chicago Athletic Club (foreground), and newer buildings, such as the steel-and-glass structure (background), present very different challenges when the goal is to build/renovate to achieve a sustainable facility. Our annual green-construction issue is full of information to help you reach that sustainable goal.

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CBP*digital* EXTRAS

To learn more about the products mentioned in the features in this issue, visit our digital magazine at http://www.cbpmagazine.com/digital/oct2013. Turn to the article that interests you and click on the icon to download a spec sheet or watch a video. Below is a summary of this issue's Digital Extras.

View Walls As Systems, p. 8:
Click on the Digital Extra icon for this feature and download more information about wall systems.

Schools Gain From Metal Roofs, p. 10:
This Digital Extra is a video about the clipping system used to attach the Butler panels to a building.

Balance Energy Efficiency And IAQ, p. 14:
Click on the icon in the digital magazine and use a calculator to determine energy savings with the Modine Atherion system.

Are Your Transfer Switches UL 1008 Listed?, p. 18:
The icon will take you to the ASCO Power University website, which contains a wealth of information.

Make Emergency Lights A Priority, p. 22:
Click on the Digital Extra icon in the digital magazine to watch a video about Lithonia's ELMLT emergency light.

Rigid Foam Spells High Performance, p. 28:
The Digital Extra link for this article produces the manual for the Insulfoam rigid-foam-roofing insulation product.

Tubular Daylighting Devices Demystified, p. 34:
Click on the Digital Extra icon at the end of this story to download a brochure that describes the how the Solatube TDDs function and perform.

Metal Makes The Shade, p. 39:
Click on the Digital Extra icon in the digital magazine to visit the Gallery area of the McNichols website and view the many projects that use the company's products.

Downtown Garden Blooms With Aluminum, p. 40:
The Digital Extra link for this article produces the Alucobond technical guide.

Kolbe & Kolbe Millwork Co. ad, p. 21:
Clicking on the Digital Extra icon will provide you with specifications for the company's 4500 series tilt-turn windows.

CBP COMMERCIAL CONVERSATION

As part of our variety of online editorial products, *Commercial Building Products* presents Commercial Conversation at http://www.commercialconversation.com. Commercial Conversation is a series of semi-monthly podcasts in which the editors speak with commercial-construction industry experts about issues that affect specifier decisions. Podcasts are supported by a resource page and are available for download from the website.

Glass For Interior Spaces: Diane Turnwall

Diane Turnwall, market segment director for interiors at Guardian Industries Inc., Auburn Hills, MI, offers insight into the growing trend of using glass for interior walls and to define inner work spaces. In the podcast we talk about sound, privacy, lighting, safety, wayfinding, and other glass-related factors.

Fenestration Spec Factors For Buildings: Mike Turner

Mike Turner, vice president of marketing at YKK AP America Inc., Austell, GA, and board member of the American Architectural Manufacturers Association, Schaumburg, IL, returns to discuss factors to consider when specifying fenestration for various building types. This podcast accompanies his article on p. 13 in which he discusses regional factors that affect fenestration specifications.

Sustainability And Its Future: Gale Tedhams

Gale Tedhams, director of product and supply chain sustainability, Owens Corning, Columbus, OH, shares her views of current trends and the future of sustainable construction, along with the roles the LEED, IgCC, and BioPreferred programs are playing in the process.

Making Labs Work For Today's Research: Jay Brotman

Jay Brotman, AIA, and a partner with Svigals & Partners, New Haven, CT, is a leading expert in laboratory design. In our ninth podcast, he discusses the latest trends in laboratory design, the impact of sustainable construction, and the challenges of renovation projects.

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- **Construction spending hits four-year high in July**
- **Architecture Billings Index stays positive**
- **More than 4.3 million live/work in LEED-certified buildings**
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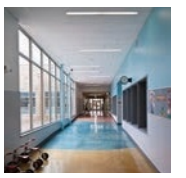
Some Green Questions








While sustainable, "green," construction is always on our mind, each year it receives much more attention in our October issue. This year is no exception. In the following pages we offer green features on wall systems, insulation, indoor air quality, solar lighting, and metal roofing, in addition to many sustainable/energy-saving products. But all of this green content got me thinking and, as so often happens, the thinking generated questions:

Has the green movement reached some level of maturity? Not too many years ago there was genuine excitement and interest in whether any product or construction technique was sustainable and to what degree. Great strides were made to advance the design of virtually all building products to make them from sustainable materials, using green methods. Most important, the advances resulted in products that dramatically cut energy costs and greatly improve our working and living environments. I don't hear/see that excitement today. Have we hit a plateau? Are we simply at a lull in development? Have we entered a phase in which all we'll see, with a few exceptions, are incremental gains?

Have relatively stable energy costs made us complacent? At the time of all of the excitement we were also experiencing significant increases in energy costs. The most painful was the increase of gasoline from less than $2/gallon to the $4 neighborhood. Gas costs have stabilized, for the most part. Heating and electricity costs have also been relatively stable for some time. Couple that with building products that truly save energy and the sting of rising energy costs is not so painful. Would another determined rise in energy costs set off green movement number two?

Has green/sustainable simply become a way of life? Eventually all "new" things become integrated in our lives and taken for granted. The novelty long-ago wore off; air conditioning, TV remote controls, the Internet, smart phones, fast food are all simply taken for granted. It seems that the novelty is also wearing off of sustainable/green/energy-saving construction. When we install new windows, we're back to considering how they work and look. The fact that they'll save energy and control solar heat gain is expected and assumed. Installing a new HVAC system? You not only assume it will be efficient, you expect it to be significantly more efficient than the system it replaces. Putting a new exterior on a building? Looks are what matters. Better insulation and moisture management are expected. I think I just answered my first question about reaching a level of maturity.

Don't misunderstand. I'm not pooh-poohing sustainable construction. It's a vital part of any project, whether it's a new building or a renovation. But we're certainly long past the kid-in-a-candy-store phase. It's time for something new. Affordable, manageable building automation? Commonplace zero-energy buildings (not sure that's practical)? Low-entry-cost solar-energy technology?

I'm not sure what it will be, but I'll have questions when it arrives. cbp

Gary L. Parr
Editorial Director

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HPDs Expand EPD Coverage

A proposed health product declaration expands upon EPDs by including consideration of human health and environmental toxicity.

Denis Darragh, Forbo Flooring Systems, North America

In 1987, the United Nations' Bruntland Commission Report defined sustainable development as the ability to meet the needs of the present, without compromising the ability of future generations to meet their own needs. The resulting sustainability policy addressed economic, social, and environmental concerns.

Since then, environmental product declarations (EPDs) have become the standardized tool for communicating the environmental performance of a product. However, in their current form, EPDs address only the environmental dimension of the sustainability policy without speaking to the social or economic dimensions. A building's owner or occupant should be able to use EPD information to gain assurance that the interior spaces they manage or inhabit are healthy ones. A group of architects, building managers, and manufacturers has responded to this EPD information gap by creating a health product declaration (HPD), a standard for product-hazard reporting that reflects issues of human health and environmental toxicity.

As the sustainability movement has evolved, life-cycle assessment (LCA) has become a measure of the environmental impact of a product over the course of its life. The analysis takes into account the processes of raw-material extraction, production, transportation, installation, use, maintenance, and end of life. Environmental-impact categories, assessed as part of the life-cycle assessment, include abiotic depletion, ecotoxicity, human toxicity, acidification potential, eutrophication potential, global-warming potential, ozone-layer depletion, and photochemical-ozone-creation potential.

A product category rule (PCR) is a standardized technical document that defines how a LCA is conducted and reported for a particular group of products. The results of the LCA are documented in a third-party-verified EPD, allowing an apples-to-apples environmental comparison between products in the same category. However, some PCRs, including the flooring PCR, omit two LCA impact categories that are crucial when evaluating a product's sustainability: ecotoxicity (the harmful effects of a substance on ecosystems) and human toxicity (the potential of a substance to do harm to human life). Without these data, the resulting EPD is incomplete.

The HPD standard combines data from the EPD with verifiable measures of ingredients that may be toxic to humans and the environment. The HPD uses an open-source approach to decide which criteria are included. By using the open-source approach that has proven successful in the computer software-development industry, the HPD becomes a standard that no individual or group can unduly influence.

Architects, designers, developers, and building owners are demanding more information about the environmental impact of materials, including flooring, they specify. The health product declaration (HPD), a new standard for product hazard reporting, more accurately reflects issues of health and environmental toxicity, according to advocates. ***Photo: Forbo Flooring Systems***

For the new standard to succeed, there must be a demand for transparency by the decision makers who are affected by the built environment. Architects and specifiers need to use it. Developers and building owners should insist on its presence.

Demanding full transparency in product declarations also plays a role in the soon-to-be-released LEED v4, where specifiers can avoid issues of ecotoxicity and human toxicity by focusing on environmental credits that are easier to attain, without losing the status of LEED certification. In LEED v4, Materials and Resources (MR), points previously available for regional materials and recycled content are being rolled into points available for LCAs and EPDs. Project teams will be able to request an EPD from product manufacturers that discloses relevant portions of LCA information determined by the PCR, again potentially avoiding the product's impact on ecotoxicity and human toxicity.

By considering the following factors, commercial-construction professionals can promote an environment of healthy transparency and create a more sustainable world:

- Insist upon full disclosure. If you specify building materials, require the information that is found in EPDs and HPDs, when they become available.
- Before you make a decision on a building material, consider all of the ways it can contribute to a healthy environment. Is it sourced from sustainable materials and designed to minimize construction waste? Does it emit compounds that might affect human health? Are excessive amounts of energy or scarce raw materials used in its creation? Can it be safely removed and naturally recycled at the end of its working life?
- Speak to others about the need to pay attention to ecotoxicity and human toxicity. Be willing to network with your colleagues in other firms about the issues and work to create an ongoing dialog.

Not considering these factors is the equivalent of taking a step backward when it comes to the benefits that really matter: the long-term health of our industry and the welfare of our children, grandchildren, and future generations. The legacy of products such as asbestos, lead-based paint, and urea-formaldehyde insulation are a reminder that business choices can have profound human consequences and that personal irresponsibility can lead to tragedy for corporations and balance sheets, as well as individuals. cbp

Denis Darragh is the general manager of Forbo Flooring Systems, North America, Hazleton, PA. He is a past chairman of MTS, the Institute for Market Transformation to Sustainability, Washington.

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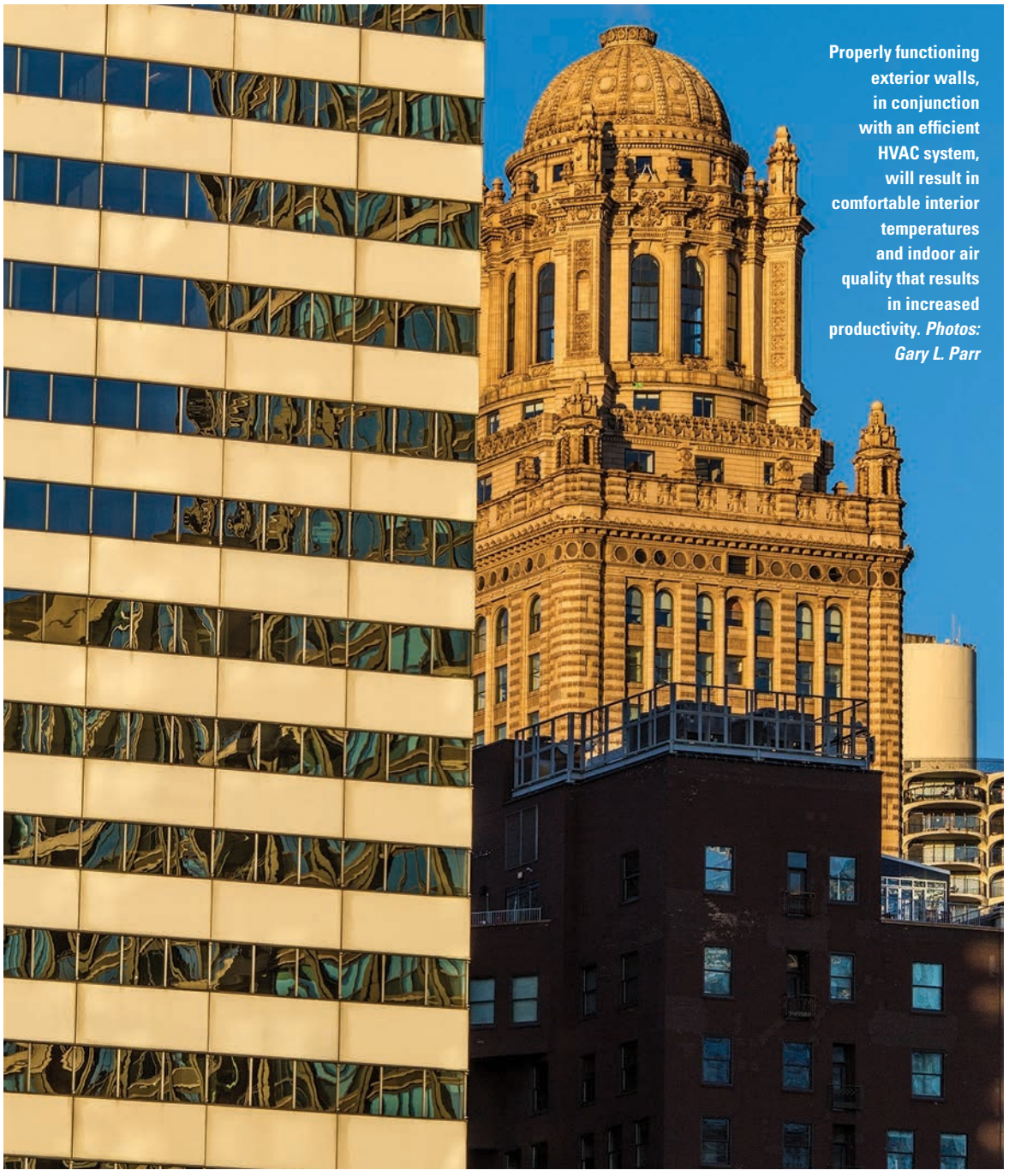


Properly functioning exterior walls, in conjunction with an efficient HVAC system, will result in comfortable interior temperatures and indoor air quality that results in increased productivity. *Photos: Gary L. Parr*

View Walls As Systems

When exterior-wall components are combined as a system, moisture management, indoor air quality, and fire safety are greatly improved.

Achilles Karagiozis, Owens Corning Corp.

Commercial occupants spend an average of eight hours a day in a building, making them the ultimate gauge for the performance and comfort of the structure. From pipes leaking and staining ceiling tiles to indoor temperature fluctuations, occupants are the first to feel the effects if the commercial-building environment has performance issues.

As a result, a chief concern in commercial building is maintaining the integrity and consistency of the indoor environment and accounting for the heat and moisture radiated into the building space by each occupant throughout the workday.

Fortunately, building-science advancements are enabling architects and builders to refine the specification and building process and providing a properly balanced commercial building that handles interior loads and delivers the optimal thermal environment for occupants.

It is the optimization of moisture management, indoor air quality, and energy efficiency across the exterior building envelope and interior mechanical systems that achieves the overall comfort and long-term performance of any commercial property. If all of these components fail to work together, a comfortable working environment cannot be achieved.

Moisture management

Moisture management addresses air leakage, and water and vapor diffusion, control, and condensation, making it a critical component of comfort. Today's commercial architects understand the importance of addressing air leakage, water movement, vapor diffusion, and moisture accumulation, and they design with moisture management in mind to avoid degradation of the thermal envelope and other potentially negative consequences. This is particularly important in steel-stud, framed-wall systems where materials are susceptible to damage from persistent water accumulation.

Another important area of moisture management is pipe condensation, which can lead to higher operating costs, maintenance costs from damaged ceiling tiles, and safety hazards. At operating piping temperatures below the dew point of the ambient air, moisture can diffuse and condense within the insulation or on the cold pipe surface. With time, the condensed water will accumulate, reducing the R-value of the insulation and possibly resulting in dripping, which can stain ceiling tiles and damage building contents.

Indoor air quality

Architects and mechanical specifiers are equally concerned with indoor air quality as it relates to comfort. Thermal performance of mechanical systems in a commercial building is just as important as the thermal performance of the building itself. The air exchange through the mechanical system that balances conditioned new air with recycled air directly affects the building's humidity levels and temperature control, two of the primary issues an occupant will want resolved.

Properly aligned ductwork, with the right levels of insulation, will help to efficiently deliver the thermal conditioned air and eliminate noise levels. In air-handling systems there are several product solutions that deliver performance, energy, acoustics, and safety enhancements.

For example, duct-lining material is a valuable improvement to the sheet-metal air-handling system. Liners provide acoustic and thermal attributes that help control air temperature and manage acoustics.

Energy efficiency

The ongoing demand to reduce energy use/cut building-operating costs is placing increasing pressure on architects and builders to maximize efficiency without compromising the environ-

ment. These professionals recognize the pivotal role and impact that wall components play in creating a tighter building envelope while providing higher energy efficiency and performance.

Building-science advancements are creating exciting breakthroughs in the collective ability to design and build a durable, high-performance building that can provide unparalleled comfort for its occupants. One area of growing interest to architects, builders, and building owners is the single-sourced, systemized approach to wall construction.

In the past, architects tackled the complex process of specifying individual wall components to deliver the best indoor environment for the occupants. Amidst changing building-code regulations, the wall-material selection process has become even more challenging and confusing.

As a one-stop solution, the new generation of complete wall systems helps to remove risk from the specification process and takes the guesswork out of the equation. The products that comprise a complete wall-system solution are specifically designed to achieve a wide range of important benefits that include thermal and energy efficiency, air and moisture management, fire compliance, and reduced energy costs.

Thermal and energy efficiency

Continuous insulation is a critical component of any wall system as it minimizes the negative effect of thermal bridging, thermally seals the exterior building envelope, and helps to maintain overall building operating efficiencies, resulting in reduced energy costs.

Whether reducing lateral heat flow into or away from the steel-stud flange, continuous insulation reduces thermal bridging that robs energy. The result is increased overall thermal performance of the entire wall.

For example, during the cooling season, when heat flow is from the outside in, insulating sheathing reduces lateral heat flow through its large surface area to the exterior flange of the steel stud so there is less heat transferred through the steel-stud thermal bridge into the building.

Air and water

The insulation incorporated into complete wall systems enhances the thermal and moisture resistance of buildings by minimizing intrusion of unconditioned, moisture-laden air into the wall assembly. This also provides a secondary layer of external moisture resistance behind the cladding to help protect the building.

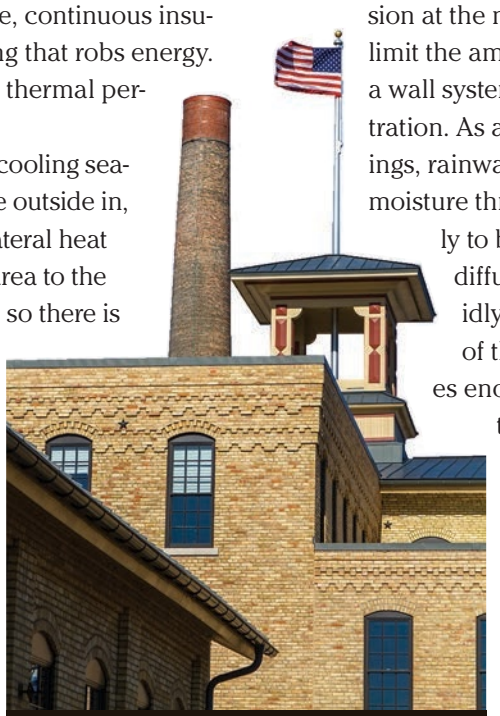
Air intrusion is one of the most significant sources of moisture that may cause condensation inside a wall. The accumulation of hidden moisture may lead to corrosion of wall-framing materials and the growth of mold and mildew. A high-quality air-barrier system is always part of a high-performance steel-stud masonry veneer wall system.

Resistance to air intrusion enhances the thermal and moisture resistance of buildings by minimizing intrusion of unconditioned, moisture-laden air into the wall assembly. The water-resistive barrier provides a secondary layer of external moisture resistance behind the cladding to protect the building.

Indoor air, warm, and seemingly dry, if sealed in a jar and taken outside and cooled, will condense water or "excess moisture" on the inside walls of the jar. If the same warm air leaks through a hole into a wall, migrating until it reaches a surface colder than its dew-point temperature, the same condensation will occur. If that condensation happens it will most likely be in a location that can't be seen and eventually may cause damage.

An air barrier can limit the flow of warm, moist air into a wall. However, even if the wall is sealed with an air barrier, unless the wall is properly vapor protected, water vapor may still diffuse into the wall on the molecular level, where it may also encounter dew-point temperature and condense with the same damaging result. Complete wall systems provide multiple options for a designer to manage vapor diffusion.

Vapor retarders limit the amount of moisture that can enter a wall system through diffusion at the molecular level. Air barriers limit the amount of moisture that enters a wall system because of moist-air infiltration. As a source of moisture in buildings, rainwater and mass transport of moisture through air movement are likely to be many times greater than diffusion. When air moves rapidly through a wall it can get all of the way outside before it loses enough heat for condensation to occur. However, in a wall deliberately constructed to be tight, slow flow will probably ensure that cooling and condensation occur before the leaking air gets outside. Steel studs, masonry wall ties, gypsum board, and the screws that hold it all together, are all materials that may be damaged by long-term condensation. Regardless of how moisture vapor gets into a wall, once it gets in, condensation is the concern.



When wall components are specified and assembled to function as a system, moisture management/control should be a primary concern. Accumulated moisture in walls, particularly if steel studs are used, causes degradation over time and eventual expensive repairs.

In steel-stud, framed-wall systems, where materials are susceptible to damage from water-vapor condensation, there are several design strategies that effectively minimize or prevent condensation. Complete wall systems incorporate each of these strategies:

- Install continuous-insulation sheathing to keep the materials in the wall above the dew-point temperature.
- Install a properly placed vapor-retardation layer to limit water-vapor diffusion into the wall.
- Install air barriers to limit the amount of moisture-laden-air leakage into the wall.
- Omit stud-cavity batt insulation, which places the vulnerable steel-framing components at room temperature.
- Limit the accumulated condensation to an amount that can be safely absorbed, stored in reservoir materials, and reliably evaporated under summer conditions.

Fire resistance

The International Building Code (IBC) requires that fire-resistance ratings for wall assemblies be determined by testing in accordance with ASTM E119. The test evaluates a wall assembly's ability to maintain its structural integrity and survive hose-stream exposure, with limited passage of heat, flame, and smoke, while exposed to the test fire for a specific period of time.

Single-source wall system solutions, such as Toledo, OH-based Owens Corning's CommercialComplete wall systems, are specifically designed and tested to ensure building-code compliance and fire-test requirements, including ASTM E119 and NFPA 285.

The streamlined approach to walls saves time and money during the design and construction process, as well as long-term operations and maintenance of the building to achieve optimum results. These interdependent wall-system solutions also extend the ability of architects to tailor designs with geography and occupants in mind resulting in increased occupant comfort, reduced callbacks for builders, and reduced building life-cycle energy costs. The result is positive financial implications for building owners. CBP

Achilles Karagiozis, Ph.D., is the global director of the Building Science group for Owens Corning, Toledo, OH. Prior to joining Owens Corning, Karagiozis worked at Oak Ridge National Laboratory, Oak Ridge, TN, where he was a distinguished research engineer and hygrothermal project manager.

Schools Gain From Metal Roofs

Knowing the ABCs of metal roofing helps schools unlock grade-A benefits such as construction costs and energy savings.

Rodger Russ,
Butler Manufacturing Co.

Metal roofing is gaining acceptance at educational facilities across the United States because school boards, administrators, and facility managers are attracted by its durability, longevity, and visual appeal. In addition, metal roofing has environmental attributes that contribute to green-building certifications and energy-code compliance.

Metal roofing is right for new and existing buildings. When planning new educational facilities, metal roofing is a solution that has short- and long-term appeal for decision makers. For existing facilities where efficiency, performance, and maintenance similarly are major concerns, almost any facility can be reroofed or retrofitted to realize cost savings that can then be allocated toward other capital improvements.

For school decision makers, some reasons to choose metal roofing systems over single-ply and built-up systems include:

- **Going green.** Steel is the most recycled material on earth, and recycled steel is a component to many metal-roofing systems. Metal-roofing systems, when used in a tested assembly, can achieve a thermal efficiency rating of R-40 or higher, helping schools reach their sustainability goals and meet LEED, Energy Star, and Cool Roof Rating Council standards.

The cool-roofing concept uses highly reflective paint that helps lower roof temperatures and reduces the amount of energy required to cool a building. For schools in warmer climates and urban areas, cool roofing also mitigates the heat-island effect,

▲ Lake Hamilton Intermediate School, Hot Springs, AR, is an 87,000-sq.-ft. facility that includes a Butler MR-24 metal-roof system with a burgundy finish to match the school's colors. The building also uses Butler's StylWall II Flat wall system and Widespan structural system that deliver an R-19 insulating value.

▼ The roof design at Fryeburg Academy combined the feel of an historical campus with a contemporary touch. Differently scaled elements, including varying roof levels, a porch on the front of the field house, and tall-windowed gallery spaces on the outside of the theater, contribute to the effect.

▼ **Daylighting, installed in conjunction with metal-roofing systems, continues to gain momentum at educational facilities because it can reduce electrical lighting consumption and costs by as much as 70%, according to the U.S. Department of Energy, Washington.**

which produces high relative temperatures that contribute to smog formation. School administrators, boards, and facility managers should look for paint finishes with a high solar-reflectance index and that have been approved by the Cool Roof Rating Council, Oakland, CA, an independent, nonprofit organization that maintains a third-party rating system for the radiative properties of roof-surfacing materials.

- **Longevity and durability.** Outlasting many conventional roofing systems, metal roofing is weather tight and minimizes maintenance. Sophisticated metal-roofing systems offer factory-punched panels and structural members to ensure proper alignment, accurate installation, and leak protection.
- **Life-cycle cost savings.** Metal-roofing systems contribute to maintenance and energy cost savings, freeing up dollars for educational facilities to use elsewhere.
- **The beauty of metal roofing.** Beyond purely financial and practical considerations, curb appeal is often a motivating factor for school decision makers. A far cry from the drab, dated roofing of warehouses and factories of yesteryear, metal roofing is now a stylish, modern option for educational facilities. It comes in a full spectrum of colors and finishes. Influencers can match their school colors to display their school spirit. Furthermore, many manufacturers offer resin-based fluoropolymer finishes that resist fading and protect against blistering, peeling, and chipping of the paint.

Attention-grabbing architectural designs can be achieved through the curving properties of metal, making metal roofing an ideal choice for facilities in which rooflines play an integral role in the overall aesthetic beauty of the building. Architects have the flexibility to incorporate curved or steep-slope accents.

Deliver light to education

Daylighting, installed in conjunction with metal-roofing systems, continues to gain momentum at educational facilities. In expansive spaces at schools, such as gymnasiums and auditoriums, daylighting is an effective way to achieve energy-efficiency goals by substituting daylight for electric lighting. When integrated with a lighting-control system, daylighting can reduce electrical lighting consumption and costs by as much as 70%, according to the U.S. Department of Energy, Washington. With the operational savings gained from installation, a return on investment may be realized by educational facilities as quickly as three to five years.

Creating a pleasant learning environment for students and staff is an added benefit of daylighting. At times, sunlight can be excruciatingly bright in large spaces, and shading controls may be difficult to effectively operate in shared environments such as classrooms. Integrating daylighting technologies with metal-roofing systems ensures even distribution of light to provide superior illumination for classrooms and other spaces. Adding natural daylight to a facility's interior not only increases occupant comfort but also can further academic success, according to research completed by the Univ. of Nebraska at Lincoln.

Many daylighting solutions are designed to maintain the structural integrity of metal roofing systems, and the highest quality technologies can be incorporated without using obtrusive roof curb systems. With simple and easy installation, schools can save on labor costs and immediately realize daylighting benefits. Daylighting technology can be integrated into new school construction or roof retrofits, providing design flexibility and versatility to school decision makers.

Several metal-roofing systems manufacturers offer web-based calculators that demonstrate the savings potential available through daylighting, tracking the return on investment, and showing decision makers real-time energy savings.

When its 50-year-old gymnasium burned to the ground, the Fryeburg Academy had an immediate obligation to rebuild and to do so as cost-effectively and as quickly as possible. Part of the solution was a metal-roofing system on the new gymnasium to match that of other buildings.

Savings justify initial investment

Often, the biggest obstacle to implementing metal roofing at educational facilities is cost. For many cash-strapped public and private schools, it can be a challenge to justify the added expense of metal roofing. However, performing a life-cycle cost-savings analysis reveals that metal roofing pays off in the long run.

The concept of a life-cycle cost advantage is typically introduced to buyers when a product carries a higher initial investment than a comparable product. In this respect, metal roofing systems are a virtual trifecta, outperforming conventional roofing systems in environmental, energy-saving, and durability categories at a significantly lower price point. A leading manufacturer of metal roofing systems recently compared a standing-seam metal roofing system to a rubber, single-ply conventional roofing system on a 50,000-sq.-ft. roof area, based on a life-cycle cost analysis of 30 years. The analysis revealed a six-

figure life-cycle cost benefit of metal over rubber single-ply roofing systems.

Central to the life-cycle cost advantage is the fact that metal roofs need to be replaced less frequently than single-ply and built-up roofing systems, making the total cost of the roof, as measured over its expected life, much lower. In fact, the expected life cycle cost/sq. ft. for a metal roof is 30 cents, compared with 57 cents for single-ply roofs, according to Ducker Worldwide, a market research firm based in Troy, MI. On average, metal roofing has a 25- to 30-year life, far outlasting the lifespan of single-ply and built-up roofs. In total, educational facilities can save 35% to 50% on upkeep and maintenance costs with metal roofs.

Complement history

Fryeburg Academy, Fryeburg, ME, a private coeducational day and boarding school founded in 1792, is reaping the benefits of a metal-roofing system. When its 50-year-old gymnasium burned to the ground, the school had an immediate obligation to rebuild and to do so as cost-effectively and as quickly as possible. Decision makers also wanted the new buildings to complement the school's long history and help attract new students.

The design integrated the contextual feel of a historical campus in a contemporary way. Differently scaled elements were used, including varying roof levels, a porch on the front of the field house, and tall windowed gallery spaces on the outside of the theater.

Working in tandem with an architect, a builder trained to work with products from Butler Manufacturing Co., Kansas City, MO, specified and installed an MR-24 metal roofing system for the field house and arts center. Construction was completed in less than a year. The roofing system was part of a pre-engineered solution, which also included Butler structural systems. These systems were chosen by Fryeburg Academy stakeholders for their low maintenance, long life, and architectural appeal.

Administrators at Fryeburg Academy realized joining forces with a qualified third-party metal-roofing consultant and architects versed in metal roofing systems would be beneficial because neither general contractors nor architects are responsible for the installation or maintenance of metal roofing systems. For this reason, educational facilities should consider collaborating with companies that specialize in metal roofing and offer expertise and individualized support. CBD

Rodger Russ is the North American sales manager for the roof division of Butler Manufacturing, Kansas City, MO.

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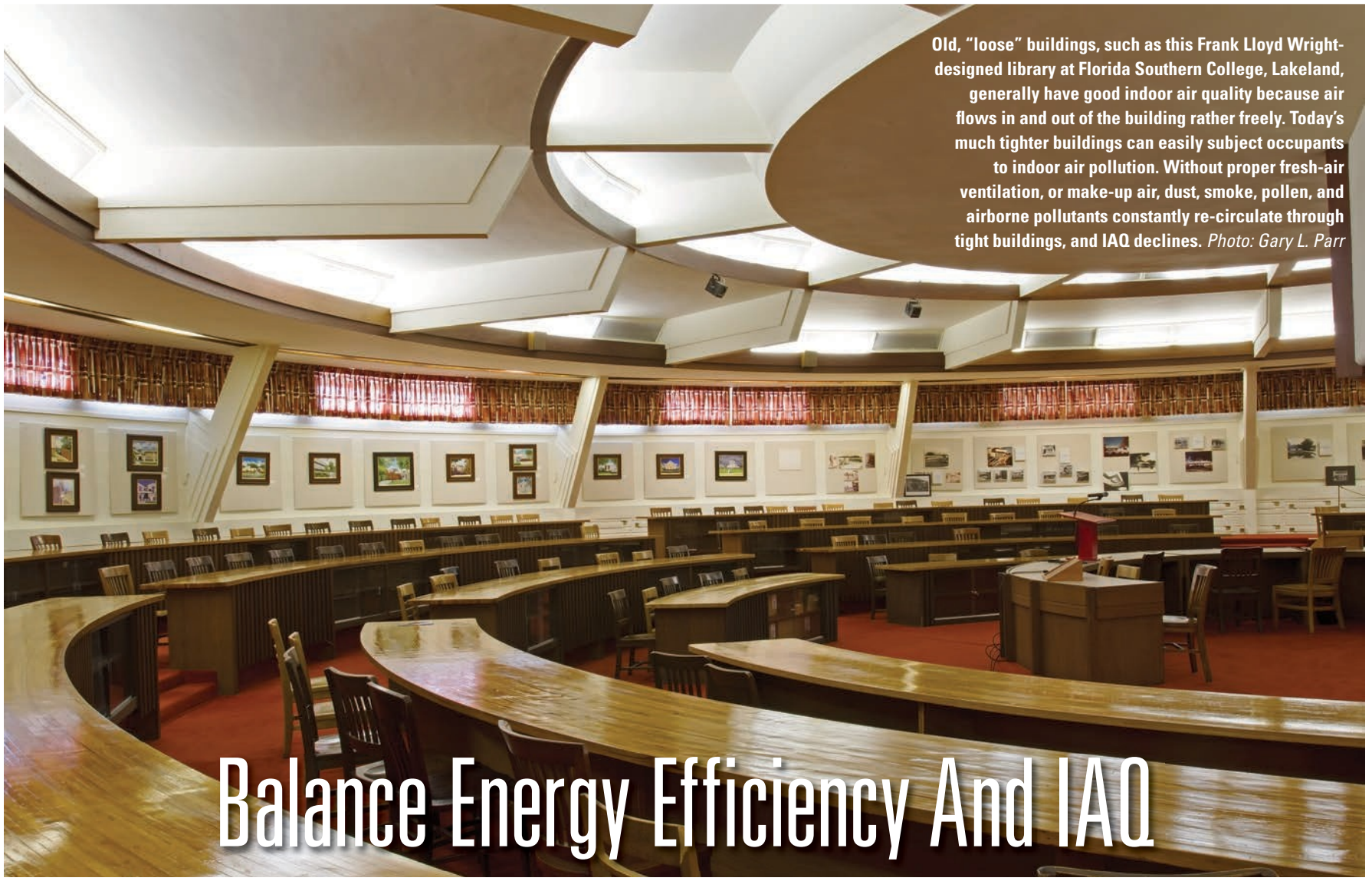

Old, "loose" buildings, such as this Frank Lloyd Wright-designed library at Florida Southern College, Lakeland, generally have good indoor air quality because air flows in and out of the building rather freely. Today's much tighter buildings can easily subject occupants to indoor air pollution. Without proper fresh-air ventilation, or make-up air, dust, smoke, pollen, and airborne pollutants constantly re-circulate through tight buildings, and IAQ declines. *Photo: Gary L. Parr*

Balance Energy Efficiency And IAQ

In the push to make structures tight and energy efficient, some buildings were built like hermetically sealed containers. Preventing infiltration and exfiltration and reducing ventilation saves energy, of course, but the downside is occupants are captive to carpet, paint, and adhesive off-gassing, in addition to other building pollutants that influence indoor air quality (IAQ). According to the Environmental Protection Agency (EPA), Washington, indoor pollution sources that release gases or particles into the air are the primary cause of indoor air quality problems in commercial facilities.

Negative pressure affects tight buildings, such as hospitals, clinics, and biomedical facilities, because exhaust fans push inside air outside, and not enough fresh air is provided to replace the exhausted air. Without proper fresh-air ventilation, or make-up air, dust, smoke, pollen, and airborne pollutants constantly re-circulate through tight buildings. It's also possible that combustion appliances may backdraft due to negative pressure, spilling harmful emissions back into enclosed spaces as humidity accumulates and IAQ declines.

"There is a variety of commercial equipment and appliances that forcibly expel inside air," said Mike Schires, senior product manager for Racine, WI-based Modine Manufacturing Co.'s Commercial Products Group. "Laboratories and kitchens have exhaust hoods. Industrial buildings have exhaust for welding stations, paint-spray booths, chemical-wash tanks, and machinery heat rejection." (See sidebar, *Engineering Firm Invests In IAQ*).

Tightly sealed structures may be efficient, but indoor air quality shouldn't suffer to achieve that efficiency.

John Vastyn, Common Ground

"If you do nothing to bring air back into the building, there will be problems with IAQ," he said. "The building will pull air from anywhere it can. And this is what creates a negative pressure condition. Air from outside comes in through cracks in walls and windows or even around ostensibly 'sealed' junctures at walls, roof lines, and wall penetrations."

"This is uncontrolled infiltration and it causes drafty, uncomfortable conditions, as well as increased dust and dirt in the building," Schires continued.

The problem doesn't end there, however. "If there is equipment with natural draft venting, [negative pressure may cause] air to be drawn through the stack rather than venting out," Schires added. Harmful or lethal contaminants, such as carbon monoxide, are brought inside, or air could be drawn in from other parts of the building and, with it, unwanted odors, chemicals, and humidity.

One indicator of negative pressure that may be obvious to building occupants is that doors can be hard to open. To correct the problem, make-up air must replace, or make up, what is being exhausted.

Loosen up

It seems contradictory that a building made airtight to save energy should be loosened up to become healthy, but that is the reality.

Ventilation air is normally occupant-demand driven. Take, for example, a high school gym where children are playing and practicing. They exhale CO_2, water vapor, and perhaps a familiar oh-so-human smell. It doesn't take long and the need for ventilation becomes essential. "At this stage, maybe not a lot of ventilation is needed because there are only 10 to 20 kids and a coach," said Schires, "but when the big game comes, conditions change in a hurry.

"The room's population is a game-changer," Schires explained. "If nothing is done, that

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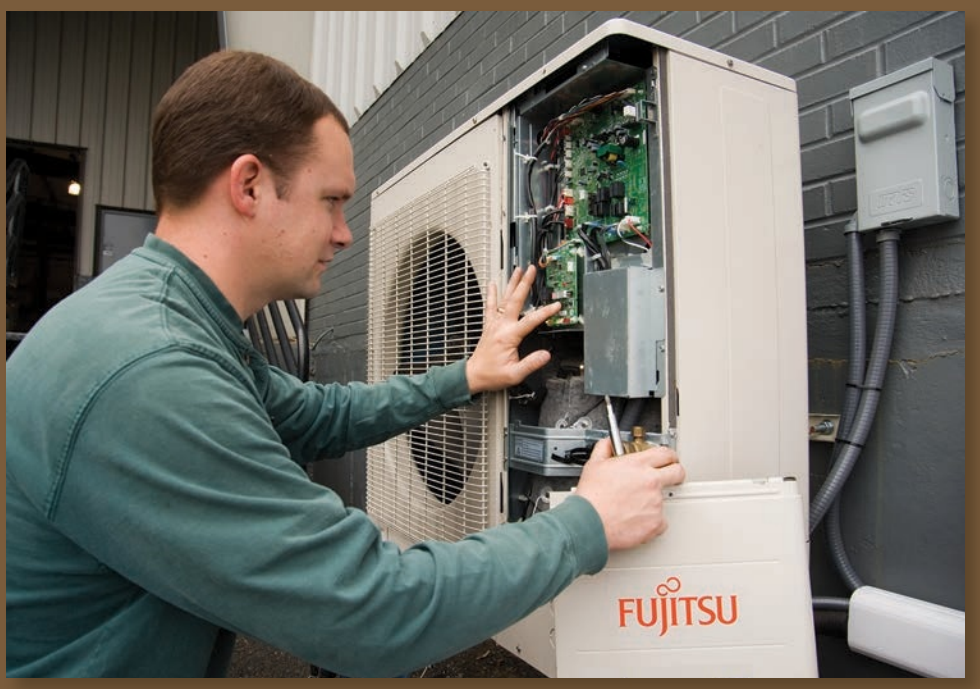

A Fujitsu high-efficiency condensing unit is installed at Cornerstone Church, California, MD. The Fujitsu mini-split systems were paired with a 15-ton Modine Atherion unit, offering ERV-conditioned fresh air, AC, and heating capabilities.

One-Two Punch Lowers Energy Use

Every once in a while two separate technologies come together so perfectly they dramatically improve the other's performance and application possibilities. Such is the case with a commercial rooftop energy-recovery ventilator (ERV) and a ductless, mini-split, heat-pump system. The benefactors of the union are the 350 members at the Cornerstone Presbyterian Church, California, MD.

The design phase for a new wing of the church was a six-month process. Several contractors, reps, and engineers offered different views about how to condition the single story, 14,000-sq.-ft. addition, which mainly comprised classroom space.

After careful consideration, church members settled on a hybrid system that would tap an ERV to supply make-up air to mini-splits equipped with make-up-air collars.

The idea of using an ERV to supply outside air to ductless mini-splits was Frank Simmons' brainchild. Simmons, owner of Simmons Heating and Air Conditioning in Hollywood, MD, knew he'd need to pull some expertise on board to design and refine the system. Although he had the tools and the know-how to tackle the project, Simmons knew the hybrid system he was hoping to install was, for the most part, uncharted waters.

Simmons took his idea to Ken Herne, at manufacturer's rep firm Harry Eklof & Associates Inc. Located in Landover, MD, the company has 10 years of experience with ductless heat-pump applications.

Herne and Simmons proposed using Fairfield, NJ-based Fujitsu's HFI (hybrid flex inverter) ductless heat pumps with ceiling cassette evaporators equipped with outside-air collars. The quandary came when it was time to select the ERV. At the beginning of the design phase, there weren't any obvious best options. No single ERV manufacturer seemed to have exactly what they were looking for.

In the time it took for the project to come together on paper, a new player came onto the field; one that seemed as if it had been custom tailored to the needs of Cornerstone Church.

The "secret weapon" of choice, to work in concert with the mini-split systems, was a 15-ton Atherion from Modine Manufacturing Co., Racine, WI, offering ERV, AC, and heating capabilities in a compact rooftop package.

At Cornerstone, the packaged ventilation system supplies ERV-conditioned air to the collars on the cassette units, in turn reducing the required capacity of the heat pumps. The unit's ERV is rated at 65% "effectiveness" a term used to describe how effectively an ERV transfers energy from the exhaust air to the supply air.

A technician prepares refrigerant lines for a ceiling cassette in the addition at Cornerstone Church, California, MD.

"Add the ERV's efficiency to the rated efficiency of the HFI system and you've got a combination that's real tough to beat," says Herne. High SEER and EER ratings and the advantage of modulating operation combine optimally with the capabilities of the Atherion.

"We won twice with the mini-split approach, considering that when the split systems were sized, the availability of supplemental capacity from the Atherion was taken into consideration," said Herne. "We reduced the ductless system load by 35%."

"Should the heating or cooling capacity of the heat pumps be exceeded, we capitalize on the modulating ability of the packaged ventilation system's heating and cooling elements, delivering only the capacity needed to meet the demand, and no more," added Herne.

Equipped with 20-kW backup heat and CO_2 sensors, Modine's system will also run whenever the building's air needs to be exchanged.

"We were glad to hear that mingling the ductless heat-pump units with the packaged air handler meant less total installed capacity," said Scott Hoffman, head of the church's building committee. "But the ductless units are also great because of their ability to condition the church on a room-to-room basis. That way we aren't heating or cooling any rooms that aren't in use."

Engineering Firm Invests In IAQ

At Rite Engineering in Franksville, WI, they tap, ream, mill, drill, and bore, to aerospace specifications, everything from plastic to titanium. To justify the expense of more than a million dollars for a single machine, it has to perform up to expectations. When an entire 11,000-sq.-ft. machine shop is full of those machines, time is money. Rick Hennig, owner of Rite Engineering, knows the drill.

"The machines cost a lot of money, and they make a lot of money but only if they're running spot-on," he said. "They produce more than precision components, though. They make lots of heat, and the lubricant smokes."

Over the past several years, demand for Rite Engineering products has increased, so Hennig added more machines to his production floor. On the hottest days of summer, his workers could only get several hours of work done in the morning. By noon, they had to leave for the day; both workers and precision equipment were unable to tolerate the stifling heat and unhealthy air inside the shop; million-dollar machines sat idle.

Hennig needed a solution that would handle the whole shop. He contacted nearby Modine Manufacturing Co., Racine, to see if they could offer a cost-effective means of improving conditions at his facility. Robert Fritchen, brand sales manager of unitary products at Modine, had an answer: Modine's commercial packaged-ventilation system, a 100% dedicated outside-air system with an integrated energy-recovery ventilation (ERV) module. A 15-ton, 180,000-BTU Atherion unit was installed on a frame just above ground level outside Rite Engineering's main building.

"The day after they commissioned the unit, the first full day of use, the air quality and temperature inside the shop were infinitely better. It was hard to believe because we'd become accustomed to such poor air quality," said Hennig. "There was no haze hanging around the ceiling, and it almost felt like we were working outside."

Modine's Atherion commercial packaged-ventilation system, a 100% dedicated outside-air system with an integrated energy-recovery ventilation (ERV) module, was installed at Rite Engineering, Franksville, WI, to improve temperature and air quality for the machine shop.

It wasn't long before new orders meant more machinery. Floor space in the shop approached capacity. The comfort level workers had grown accustomed to tapered off with the addition of each new machine.

This time, Henning expanded the facility by 6,000 sq. ft. and ordered a new 30-ton Atherion rooftop system. Together, the mechanical systems keep the air clean and properly conditioned.

space will get very hot, humid, smelly, and uncomfortable in a hurry. The ventilation rate needs to be increased significantly; we measure that air exchange in cubic feet per minute (cfm)."

The bigger the crowd, the more cfm required. These are important considerations when designing interior spaces with unique needs, such as condominiums, hotels, hospitals, and schools. Perhaps, to a lesser extent, the same needs apply to churches, theaters, clinical offices, and retail stores. (See sidebar, *One-Two Punch Lowers Energy Use.*)

Outside air

Mechanical equipment for make-up air and ventilation is similar because both systems are bringing in large volumes of outside air, according to Schires. Ventilation equipment typically also includes a power-exhaust feature because, in addition to bringing in large volumes of fresh air, there also is a need to get rid of bad air within the facility and keep it balanced.

"The advantage with ventilation equipment is that, with the exhaust function performed by the same equipment, it gives building designers and owners the opportunity to incorporate energy-recovery technology," Schires stated. "This can help to reduce equipment size and energy use."

The key with either type of equipment is to properly condition the air being brought in. For instance, in Minneapolis, ambient temperatures can range between –20 F and 100 F during a 12-month period. That's a 120 F variance, including vast changes in humidity levels. The equipment tasked to introduce fresh air must also heat, cool, and dehumidify. Indoor-air targets for good IAQ are between 30% and 60% relative humidity (RH); 50% is a typical target.

Schires offered this example: "It's 95 F outside, with 40% relative humidity, and the building owner specifies a need for 75 F in the space. All that the building-systems designer needs to do is to cool that air by 20 F to get to 75 F, right? Well, as you probably know, it's not quite that easy."

"Let's say that air delivery comes in at roughly 75% RH," he continued. "That's very bad air from an IAQ standpoint and must be dehumidified." According to Schires, most packaged rooftop HVAC equipment can dehumidify only about 20%, or maybe as much as 30% outside-air exchange when ambient humidity is high.

The answer to dealing with large swings in temperature and humidity is through equipment that modulates control of heating, cooling, and dehumidification, said Schires.

Making structures more energy efficient is a worthy goal, but simply tightening the building envelope often brings with it unintended consequences, such as increased indoor pollution and uncomfortable, unhappy occupants. Careful attention to make-up and ventilation air is the solution that will result in a structure that balances efficiency with comfort and productivity. cbp

John Vastyan is president of Common Ground, a trade communications firm based in Manheim, PA, that specializes in the hydronics, radiant-heat, plumbing and mechanical, geothermal, and HVAC industries.

Are Your Transfer Switches UL 1008 Listed?

Backup-power transfer switches that are not UL 1008 listed carry with them the potential to create a list of problems, including failure at a critical moment.

Bhavesh S. Patel, ASCO

With the growing emphasis on emergency and standby power, facility executives are taking a closer look at the elements of the backup-power system. One critical element of that system is the transfer switch. Facility executives count on their transfer switches to perform when they need to switch from the utility's electricity supply to backup generators. Mostly, transfer switches perform. But there have been notable failures.

At an Amazon Web Services data center in Virginia, an automatic transfer switch didn't work properly in May 2010, when the data center needed to shift from utility power to its generators after a vehicle hit a nearby utility pole. As a result, some Amazon customers lost cloud-computing service for an hour. In 2010, Codero's Phoenix data center experienced a power outage. The generators started as expected, but an automatic transfer switch failed. In January 2010, a NaviSite data center lost power when a transfer switch failed during a utility outage caused by a thunderstorm.

To ensure that transfer switches perform as expected, it's important that they comply with UL 1008. That standard sets a series of rigorous requirements that include "withstand-and-closing ratings," or WCR, (which cover severe fault currents, bolted faults, and short circuits within an electrical-distribution system); tests to ensure that the device can carry rated currents; and endurance tests specifying the number of cycles that the transfer switch must achieve and still perform its intended function.

But transfer switches are not the only devices that are used to transfer power. Many of those other types of switching devices do not have to meet UL 1008 and thus do not offer the assurance of having met the strict testing requirements needed for qualification to that standard.

Most transfer-switch failures don't make the news the way the ones cited above did. But failures do occur. In a survey we conducted, 20% of respondents whose facilities have transfer switches reported at least one switch failure in the past five years. In one case, "both sides of the switch closed at the same time during a test. The switch exploded," a respondent reported. Another respondent indicated the transfer-switch failure "caused elevators to lock out." A third commented that the transfer switch "failed to energize a critical intensive-care-unit circuit."

Transfer-switch failures happen in a variety of ways. But a third of respondents who experienced failures reported that the switch completely failed and became totally non-operational. The transfer switches that failed were not necessarily old units. The same number of failures was re-

When specifying, purchasing, and/or installing power-transfer switches, one of the factors that must be considered is whether the switches are UL 1008 listed. The UL-listing process will go a long way toward assuring that the switches, considered by many to be the heart of a power system, perform properly in a power-outage event.

Some 20% of survey respondents indicated that they had experienced at least one switch failure in the past five years. An eye-opening 92% of respondents do not know whether their switches are UL 1008 listed.

ported in the survey for units less than 5 years old and units 15 or more years old.

Respondents also indicated that transfer-switch failures left a significant number of facilities without power. Of respondents who experienced failures, 42% reported that their facilities lost power. More than half of the respondents who lost power said that facility loads were without power for an hour or more.

According to the survey, failures can be traced to a variety of issues, including power surges, lack of maintenance, age of equipment, and poor design. Jacob L. Huske, PE, vice president of Environmental Systems Design, Chicago, stated that the most common causes of contactor-based transfer-switch failures were poor maintenance or a misapplication of the transfer switch that resulted in power outages due to nuisance tripping of a circuit breaker external to the transfer switch during a transfer.

"I have found that many transfer-switch failures are the result of shorted-out rectifiers," observed Christopher A. Wade, principal consultant for Resilient Mission Critical Solutions, Bentonville, AR. Previously, Wade oversaw the global strategy, planning, engineering, and facilities operations for mission-critical data centers for a Fortune 100 company.

Another potential problem Wade mentioned is human error. In one case, the transfer switch was left in manual mode for a couple of months following completion of maintenance work. So, when needed, the transfer switch did not operate. "Needless to say, that was a career limiting situation," noted Wade.

Ensure switch reliability

Despite failures, transfer switches can be extremely reliable, provided that they are properly selected and maintained. The starting point is to ensure that the switch is qualified and certified to the correct UL standard. For transfer switches, that's UL 1008.

"Transfer-switch equipment tends to be very reliable when properly applied and maintained, so failures of UL 1008 transfer switches are rare," said Huske. UL 1008 was established in 1970 by Underwriters Laboratories, Northbrook, IL, to guard against transfer-switch failures and resultant potential fires. A performance standard, as well as a design and construction standard, UL 1008 requires transfer switches to undergo rigorous testing by an independent testing and certification agency.

"UL 1008 is almost always the standard used for enclosed, contactor-type transfer-switch equipment applied in the United States, including equipment installed in mission-critical facilities," explained Huske. "Where transfer-switch equipment is used for transferring critical load in legally required emergency-power applications or healthcare facilities, UL 1008 is generally the only standard that the authority having jurisdiction (AHJ) will accept."

The dependability and safety of UL 1008 transfer switches are "very important," said John Ferguson, director of facilities for Regional West Medical Center in Scottsbluff, NE. "As a hospital, we have to keep our operations safely going, even in power-outage situations, to protect the lives of our patients and our staff who are caring for them."

Ferguson isn't alone in seeing the importance of UL 1008-listed transfer switches. Bernie Harris of Cushman & Wakefield, New York, calls the UL 1008 automatic-open-transition transfer switches his client uses for its life-safety generator "very important."

And Ken Cooper, chief engineer at Sands Regency Casino Hotel, Reno, NV, said that UL 1008 transfer switches perform "very well, as long as they have proper maintenance" and are tested periodically.

From Wade's point of view, there are two major benefits of using UL 1008. One is that it simplifies the inspection process on code-required emergency power systems. "The reliability of backup-power systems is impacted by switchgear design," said Wade. "The UL 1008 standard has typically been specified for legally required standby and emergency power systems, *e.g.*, systems used for critical loads in hospitals. It is applicable for equipment up to 600 V (it does not address medium voltage) and is written for the simple standalone transfer switches. The basic UL 1008 standard does not address the reliability requirements as the system becomes more complex with multiple sources of power (utility and generators) and with the introduction of the circuit breakers."

The other major benefit of UL 1008 revolves around the device-testing requirements of the standard. "UL 1008 really relates to testing devices to validate that they will operate safely and reliably as intended," said Wade. "UL 1008 is designed to be a self-contained standard for a switch assembly and has very stringent requirements for endurance testing. It contains overload, endurance, and interruption testing criteria, in addition to all mechanical construction requirements to ensure safe operation of the switch."

Wade pointed out that the mechanical interlocking requirements of UL 1008 are significant. Mechanical interlocking is a useful safety feature for the open-transition transfer of two sources. "Some modern circuit breakers surpass the endurance requirements in the industry standards," Wade says. "Therefore, the key specification item is the circuit-breaker endurance. Mechanical interlocking can be specified for open-transition transfer on simple systems where the switchgear ar-

rangement makes it physically possible. However, mechanical interlocking is not possible in many switchgear arrangements, and electrical interlocks have successfully been employed for many years. Either method of interlocking (mechanical or electrical) prevents the accidental paralleling of the two sources, thus increasing safety."

Despite the importance of UL 1008, the results of the survey suggest that most facility executives are unfamiliar with it. Among respondents with transfer switches, only 5% said that their switches were certified to UL 1008. The overwhelming majority, 92%, said that they weren't sure about the standard to which their devices were certified. This is eye-opening information when the transfer switch is considered by most people knowledgeable about power-distribution systems to be the "heart" of power systems.

As noted earlier, 20% of survey respondents experienced transfer-switch failures in the past five years. In those cases, 97% of survey respondents were not sure what certification those failed switches had, if any. One reason that some facility executives may not know which standard their devices are certified to is that transfer switches can last a very long time. For example, Dave Lopes, chief engineer for ABM Engineering, Chicago, has some experience with failed transfer switches and is replacing them in a high-rise building with UL 1008-listed units. He's unsure whether the replaced units were UL listed "because they were vintage units." He guesses the original switches were installed around 1970 to protect power transfer to the building's elevators, the main building emergency riser, and the emergency generator.

Endurance performance

Endurance testing is a key element of UL 1008, according to electrical engineer John Drengenberg, consumer safety director at UL. The standard has tables that specify the number of cycles transfer switches at each ampere level must achieve to meet the standard and receive UL 1008 certification. Any UL 1008 transfer switch can transfer at least 3,000 times, with at least 1,000 of those operations under at least 100% of rated load. UL 1008 transfer switches rated at lower amperes must be able to complete 6,000 transfers under 100% load or greater.

A UL 1008-certified transfer switch undergoing monthly and annual testing may be operated roughly 15 times a year, according to Drengenberg. "In 100 years, that UL 1008 transfer switch will have been through just 1,500 cycles, so they are designed, built, and tested to last when they are tested and certified by UL 1008."

Drengenberg said that UL inspectors make unannounced visits to factories producing UL 1008 transfer switches and pull a sample off the line. UL also wants to hear about operational failures. "We like to get as much information as possible," he said.

Maintenance and testing are crucial to ensure that the transfer switch will respond when needed.

Finding expertise

Scott Blackman, facilities management and commissioning regional manager at Syska Hennessy Group Inc., Chicago, recommends that facilities executives consider tapping the resources of a reputable engineering firm to help them select the proper transfer switches for their business needs.

"The facility manager has tremendous experience across a broad range of operations for his or her building," said Blackman. "The advantage an engineering firm offers is that it has multiple clients with various business needs using transfer switches in many different buildings. That expertise allows the engineer to refine the transfer-switch selection process, based on

his or her experience with what works and what doesn't for numerous buildings and situations."

Huske agreed. "There are many application-specific considerations that must be addressed for any type of transfer equipment that will be used, and the best way to avoid problems is to have someone with extensive experience assist." No matter who is involved in helping select transfer equipment, it's important for the facility executive to take steps to ensure that the correct UL standard has been followed.

Proactive steps

Although proper UL certification for transfer switches is essential, it's not the whole story. Maintenance and testing are also crucial to ensure that the transfer switch will respond when needed.

"All transfer-switch equipment manufacturers publish recommended schedules for maintenance and testing, so obtaining and understanding these recommendations is the best place to start," suggested Huske. "Facility executives also should engage a qualified service company to regularly perform inspections and maintenance on transfer-switch equipment in their buildings." Regional West Medical Center relies on a third party to do load-bank testing, as well as any repair needs uncovered, when the emergency-backup system must be operated for four hours to meet Joint Commission requirements, according to Ferguson.

At Regional West Medical Center, the emergency-backup power system and its transfer switches are put through an hour of performance testing monthly, as well as periodic load-bank testing for four-hour runs following Joint Commission requirements, according to Ferguson. Two licensed electricians are on hand and, although he's had some problems with the emergency-power system, "there have been no problems with transfer switches," said Ferguson.

Remember the business model

The type of UL 1008 transfer switch to use depends on many factors, but possibly the most critical one is the organization's business model. To that end, Blackman recommends regular commissioning and evaluating transfer switches to see if they still satisfy the business model. "Today's business is constantly changing and the infrastructure, including transfer switches, often is overlooked," he noted.

He recalls a client with open-transition transfer switches that were performing as designed to an older business model. However, lights flickering and other interrupting factors of regular testing were problematic under the new business model. As a result, the organization opted to retrofit with closed-transition switches.

For new construction or renovation projects, facility executives have an important role to play in making sure the organization gets what it needs. "Facility executives must know what the actual function of the facility is going to be—data center, hospital, office building—and work with the design engineers to determine what is needed," said Wade. When automatic transfer switches are needed in the United States, facilities executives must be sure they are UL 1008 listed. Otherwise, they probably will not pass inspections by the authorities having jurisdiction over the facility. CDP

Bhavesh S. Patel is director of marketing and customer support at ASCO, division of Emerson Network Power, Florham Park, NJ. He has extensive knowledge about the power-system markets and regularly shares that knowledge by speaking at various professional-organization events.

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Quality emergency lighting that meets or exceeds code requirements ensures that occupants can safely exit a building during an emergency and that first responders will have adequate illumination when they arrive.
Photo: Lithonia Lighting, Acuity Brands Lighting Inc.

Emergency-lighting standards have been in place for decades and have been modified over time to improve the safety of building occupants. Despite these standards, thousands of Americans perish every year, while many more suffer personal injuries in building emergencies that range from fires and explosions to blackouts and collapses caused by earthquakes, hurricanes, tornadoes, and terrorist attacks.

When a calamity takes place and emergency lighting is required to assist an evacuation, the simple priority is to deliver constant quality output for as long as emergency lighting is needed and to help first responders safely enter and navigate a building.

Across the U.S., emergency-lighting systems and exit signs are used in every commercial and industrial setting. While many public and private buildings are in compliance with relevant emergency-lighting codes, consistent testing practices are critical to ensure emergency lighting is fully operational when it is needed most.

The NFPA (National Fire Protection Association, Quincy, MA) has established the Life Safety Code for local fire-inspection-agency code enforcement. To maintain these minimum requirements and ensure that emergency-lighting equipment protects building occupants when emergencies strike, monthly and annual tests are required.

Testing methods

Building owners use three common methods to test emergency lighting:

- **Manual testing.** The most timely and costly method uses an average of nearly 20 hours of effort to manually test 100 emergency-lighting

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THICKNESS	2010 R VALUE (PER ASTM C 1289)	2014 R VALUE (PER ASTM C 1289-II)
1.5	9.0	8.5
2.0	12.1	11.4
2.5	15.0	14.4
2.6	16.6	15.0 (2 layer system - R 30)
3.0	18.3	17.4

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units to keep them in compliance with NFPA 101. While manual methods can accomplish the expected goal of testing compliance, they tend to be relatively expensive.

- **Inspection service.** To avoid the excessive use of internal manpower required with the manual approach, another option building owners use is to hire a third-party inspector, such as an electrical contractor, to conduct the testing.
- **Wireless, self-diagnostic technology.** For specifiers seeking an economical compliance solution, a self-diagnostic capability, built into emergency-lighting units, has the potential to save more than $5,000 annually in testing costs. Self-diagnostic testing also provides real-time reports that increase the flexibility and simplicity of testing while reducing the time and cost associated with emergency-lighting maintenance. Self-diagnostic testing also reduces risk and liability in the event of an incident.

Know what to look for

By design, most building occupants are rarely, if ever, aware of the emergency precautions taken on their behalf, let alone the codes and regulations behind them. The majority of these codes effectively address important lighting needs during an emergency. High-performance emergency lighting increases the safety of all building occupants during emergency situations by delivering the best quality lighting for an extended period of time. Additionally, there are several key considerations when specifying emergency lighting that help exceed code standards and ensure a safe environment for building occupants:

- Emergency lighting should be energized by a connection that is independent of the general lighting in the space. Use lighting that features options with multiple battery packs for maximum remote capacity and run time.
- Egress design, including the number and placement of emergency lights, must enable prompt escape by occupants. Plan emergency-lighting placement to foster an optimal illuminated escape route.
- Codes require timing of when and how long emergency lighting must illuminate a building when an emergency occurs. Selecting emergency-lighting systems that provide enhanced visibility and constant high output for longer than the required timeframe could increase the likelihood of a safe rescue and/or escape.
- Maximum and minimum illumination footcandles are outlined in codes. Choosing the maximum illumination, with features such as refractive optics that provide high and uniform light levels, ensures clear vision.
- Emergency lighting that is automatically energized or re-energized within 10 seconds of the electrical power outage is preferred. Units should stay energized for at least 90 minutes or for the anticipated building-evacuation time.

High-performance LED lighting, such as the Quantum ELMLT unit from Lithonia Lighting, produces continuous light output and enhanced visibility throughout and beyond the code-required 90-minute mark.

The LED advantage

Today's high-performance LED emergency-lighting fixtures not only meet, but exceed, minimum emergency-lighting code requirements. As with all lighting decisions, cost, ease of installation, maintenance, disposal, and replacement are factors that affect the decision-making process. However, the ability of new emergency-lighting solutions to increase lighting quality and safety, and minimize the risk of negative outcomes, must be factored into the equation.

For example, new high-performance, long-life LEDs with quality battery options—both of which contain built-in redundancies—assure dependable operation for 90 minutes and beyond. Where many emergency-lighting units deliver decreasing light levels, new light-engine technology illuminates passageways at a constant output that exceeds code requirements and produces brighter illumination than traditional incandescent options.

The opportunity for added safety places people in a position to develop a strong return on investment that actually exceeds code standards with a payback of increased peace of mind. It is the responsibility of those involved to make emergency-lighting systems a top priority. If even a single life can be saved or an injury averted due to an emergency-lighting solution that shines brighter, clearer, and longer, the decision to exceed specification requirements can be easily justified. cbp

Scott Galentine, is value-stream manager, general-purpose emergency products at Lithonia Lighting, Acuity Brands Lighting Inc., Atlanta, where he is responsible for sales, marketing, and product development.

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Expanded polystyrene (EPS) insulation is durable, yet lightweight and easy to install. Historically used as roof insulation, its use has expanded to include wall, below-grade, and slab applications. *All photos courtesy Insulfoam.*

Rigid Foam Spells High Performance

Rigid-foam insulation is a mainstay of efficient building envelopes, but the correct product must be chosen for high thermal performance at a reasonable cost.

Ram Mayilvahanan, Insulfoam

With increasing focus on high-performance building envelopes, it is hard to believe insulation once involved layering mud between logs, stuffing old newspapers into wall cracks, or using other ad hoc methods to seal air leaks and keep heat inside structures. Today's building professionals can choose from a wide range of insulations, but this proliferation of choices makes selecting appropriate insulation products more challenging.

Rigid-foam insulations are now a mainstay of energy-efficient buildings, whether commercial, institutional, or residential. Products in this category include expanded polystyrene (EPS), extruded polystyrene (XPS), and polyisocyanurate (polyiso). Careful attention to product attributes in field applications is needed to ensure high thermal performance at a reasonable cost.

Basic types and applications

Basic types and applications of rigid-foam insulation include:

- **EPS.** Typically white, EPS is made from expanded polystyrene, fused into blocks of various densities, compressive strengths, and sizes. Historically used as a stable roof insulation, EPS has gained wide acceptance in wall, below-grade, and under-slab applications because it retains very little moisture. EPS insulation blocks can be custom cut and shaped into rectangular or complex boards and shapes to meet job specifications.
- **XPS.** XPS is typically a pastel- or primary-colored foam, depending on the brand. Manufacturers combine and melt polystyrene with blowing agents and additives, then force the liquid mixture through an extrusion die in a continuous feed, where it is shaped, cooled, and trimmed to size. The product is most commonly available as board stock of fixed size and thickness.
- **Polyiso.** Polyiso (polyisocyanurate) insulation panels are manufactured from foam, sandwiched between two facers. The material is frequently used as roof insulation. Like EPS and XPS, it is a closed-cell insulation. It comes in fixed thicknesses and sizes.

Performance characteristics

The standards governing EPS and XPS insulation are set forth in ASTM C578, *Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation,* while polyiso is covered under ASTM C1289, *Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.* ASTM International is located in West Conshohocken, PA.

When evaluating these products, key variables to consider include R-value stability, compressive strength, and moisture resistance.

- **R-value stability.** R-values for EPS, XPS, and polyiso vary based on the product density and configuration (faced versus unfaced and whether combined with other materials as composites). EPS is the only rigid-foam insulation

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that offers stable thermal resistance through the life of the product (often supported by long-term manufacturer warranties). In other words, the published R-value does not degrade over time, compared with other rigid insulations that typically lose as much as 20% of their insulating capacity during time in service.

A product's R-value stability is directly affected by the type of blowing agent used in manufacturing. Some blowing agents boost an insulation's initial R-value, but diffuse over time and are replaced with air. So, while a given product might report a higher R-value than a competitive product, it is important to review the warranties to confirm whether the value is predicted to decline over time. EPS does not contain a blowing agent and does not suffer from leakage, leading to a thermally stable product.

- **Compressive strength.** Rigid-foam-insulation manufacturers often highlight their products' compressive resistance. The implication is that stronger necessarily means better. However, over-engineering insulation design leads to unnecessary costs. For example, an under-slab application that requires the insulation to support 2.5 psi, yet has been over-engineered by installing an insulation product rated for 32 psi, will cost substantially more money (sometimes by as much as 50%) on the install cost of the insulation.

EPS insulation is available with compressive strengths ranging from 10 to 60 psi (at 10% deformation). As such, the material is suitable for nearly all required loads encountered on roofs, walls, below-grade, and under-slab applications. A testimony to the compressive strength of EPS is its use as geofoam in heavy-load applications such as highways, airport runways, and bridges.

- **Moisture resistance.** Absorbed moisture reduces an insulation's R-value and therefore its ability to insulate. Since insulation is exposed to moisture over long-periods of time (the life of the building) in applications such as below-grade or perimeter insulation, it is very important to evaluate the impact of long-term moisture exposure, as well as the impact of weather cycles seen in a typical year.

EPS releases moisture faster than does XPS, which helps it remain drier during repeated exposure to weather. One such evaluation involved side-by-side *in-situ* testing of EPS and XPS as below-grade insulation on a building foundation in St. Paul, MN. When the materials were removed after being buried under soil for 15 years, the EPS was about 75% drier than the XPS (4.8% moisture content by volume compared to 18.9%). After 30 days of drying time, the EPS moisture level dropped to 0.7%, while the XPS continued to hold substantial moisture (15.7%). While XPS was found to have lost almost half of its published R-value upon extraction, the EPS had an R-value that was 33% more than that of the XPS and, more important, had stayed much closer to its published value. The results of this study are available on the EPS Industry website (http://epsindustry.org/downloads-documents).

EPS product options

While EPS, XPS, and polyiso all have a range of benefits and uses, many building professionals are switching to EPS since it provides the highest R-value/dollar; is highly customizable into different thicknesses, compressive strengths, and shapes; and can be engineered to fit job specifications. Following are some of the EPS product types commonly available across the U.S.:

- **Flat stock.** Unfaced EPS insulation is available in either straight or tapered panels and blocks 1/4- to 40-inches-thick (thicker than other rigid foams).
- **Faced panels.** EPS can be ordered with factory-applied facers that provide enhanced moisture-protection and heat-reflection capabilities. These include polymeric facers (which are typically white) and reflective, metalized facers (silver color). EPS with fire-resistant facers eliminates the need for a slip sheet on low-slope commercial roofing jobs, which saves labor and material costs. These products are compatible with various single-ply roof coverings, including PVC, TPO, and EPDM membranes.
- **Fan-fold bundles.** EPS is available in fan-fold bundles, which consist of faced EPS panels joined together in accordion fashion for ease of carrying and rapid unfolding. A bundle of 25 attached 2-foot-by-4-foot panels weighs only about 11 pounds, yet covers 200 sq. ft. Fan-fold bundles require about 60% fewer man-hours to install than individual pieces, which substantially reduces insulation labor costs and streamlines project schedules. Such bundles are popular on roof recover jobs and also can be used in other applications throughout the building envelope, as well as within interior walls.
- **Flute-fill EPS.** Some EPS manufacturers offer specially profiled EPS insulation segments designed to fill the spaces between the raised seams on metal roofs. Such flute-fill insulation is placed quickly and easily as part of roof recovers and provides high thermal insulation and a solid, even surface for overlying roofing components. Such products help save labor and material costs, compared with building up other roof bases over existing metal roofing.
- **Composite insulation.** Manufacturers combine rigid-foam insulations into composite panels to enhance performance. Available composites include EPS bonded to high-density polyiso cover boards, as well as gypsum or oriented-strand-board (OSB) cover boards.

Such composites provide high thermal efficiency and durability, are fully compatible with adhered roof systems, and are well-suited for roofs needing to resist abuse and severe weather, such as hail. EPS-polyiso composite products typically weigh much less than composite insulations using gypsum and OSB, install more quickly, and result in less fatigue for installers. Additionally, they are lower priced than similar polyiso composite products.

- **Structural insulated panels.** SIPs continue to grow in popularity as a simple-to-use and cost-effective method for achieving high-performance building envelopes. EPS is the rigid-foam insulation typically used in SIPs.

The combination of the EPS core and OSB skins provides an engineered system with high durability and load-bearing capacity. SIPs provide continuous insulation and have fewer gaps to seal than other construction methods,

Rigid-foam insulations perform well throughout the building envelope, including wall, slab, below-grade, and roofing applications. EPS insulation is available with compressive strengths from 10 to 60 psi.

EPS rigid-foam insulation is used under the "living roof" of the Bend Metro Parks building in Bend, OR.

EPS is the rigid-foam insulation typically used in SIPs, used here at Wind River Hall, a four-story, 28,000-sq.-ft. student-housing complex at Western Wyoming Community College in Rock Springs, WY.

reducing heating and cooling energy consumption as much as 60%.

Reduce labor and material costs

As EPS provides the highest R-value/dollar, it enables building professionals to achieve high thermal performance without breaking the project budget. EPS typically costs 25% to 50% less than other rigid-insulation types. In addition to the savings from the product options discussed above, two common ways EPS can reduce insulation costs are:

- Better targeting of compressive strength. As discussed previously, insulation manufacturers sometimes market high compressive strength to distinguish their products. As a result, rigid-foam insulation is often over-engineered in under-slab and roof applications. While the compressive resistance values for EPS top out below other rigid foams, readily available EPS options are strong enough for most building-envelope applications. The material's strength is demonstrated by its frequent use as a structural fill for highways and runways. The cost of using a higher-strength insulation than the application requires can be substantial. For example, specifying a 100-psi XPS product in a below-grade application when a 40-psi EPS product would do, can almost double the material cost.
- Simplified installation with tapered roof blocks. Building professionals often create positive slopes on flat roof-deck assemblies using insulation. Because most rigid foam is available only in relatively thin sheets, this requires stacking many layers upon one another to obtain the desired slope. On the other hand, EPS insulation is available in individual blocks as thick as 40 inches. Some manufacturers have the ability to pre-cut EPS blocks into any slope 1/16 inch or greater and in virtually any custom shape to accommodate roof crickets, saddles, valleys, and ridges, along with all types of drainage systems and layouts. Since fewer separate pieces are needed, building up a slope with tapered EPS blocks requires less on-site material handling and cutting and thus installs much faster. Using tapered EPS can reduce roof insulation costs as much as 30%, compared with other rigid-foam products.

Choosing an insulation supplier

As with other building product segments, EPS manufacturers vary widely in their product quality and services. To obtain the best results, it is important to evaluate the manufacturer rather than assume all EPS is the same commodity product. Key points to consider are:

- Ensure the products meet the requirements of ASTM C 578. Many EPS products on the market do not, resulting in substantial loss of performance.
- Consider the manufacturer's range of product offerings, from standard EPS blocks to specialized product makeups, such as fan-fold bundles and insulation panels with pre-laminated facers.
- Ask if the manufacturer offers product customization. The largest manufacturers can custom cut EPS to meet a project's specifications.
- Determine the level of technical support. Some manufacturers have in-house specialists to provide design support to architects, engineers, specifiers, and contractors, including material take-offs and advice on cost-saving product substitutions.
- Take into account plant locations to reduce shipping costs, lessen lead times, and potentially meet LEED criteria for regional-materials production.

For additional EPS information resources, visit the EPS Industry Alliance at www.epsindustry.org. cbp

Ram Mayilvahanan is the product-marketing manager for Insulfoam, a division of Carlisle Construction Materials, Puyallup, WA.

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Tubular Daylighting Devices Demystified

Successful selection and application of TDDs depends on looking beyond misconceptions.

Michael Sather, Solatube International Inc.

Tubular daylighting devices (TDDs), also referred to as solar tubes, sun tunnels, light pipes, or tube lights, have changed the way commercial buildings are illuminated. The general idea is simple: a dome is attached to the roof with a self-mounted flashing or mounted on a curb; it captures sunlight; transfers it into the building through a highly reflective tube; and delivers illumination into the interior space either through a diffuser lens mounted at the ceiling level or at the end of the tube in an open ceiling.

When applied correctly, a building can be fully illuminated using natural light supplied by the TDDs for 90% or more of the occupied hours of the year, relying on the electric lights only as a backup during extremely overcast days or at night. When you consider that in a typical office space nearly half the electricity used is for lighting, the energy savings with TDDs can be significant. However, human performance benefits such as enhanced worker productivity, increased retention, reduced absenteeism, and improved student achievement are important factors that can, in many cases, outweigh energy savings.

Are TDDs the right choice for your project? What should you consider when selecting the best suited TDD? To answer these questions let's explore five myths of TDDs.

Myth 1: Tubular daylighting devices are only for residential applications or small spaces. The original TDDs that appeared on the market in the U.S. in the early 1990s were, in fact, designed for residential spaces. These units were usually between 10 and 16 inches in diameter, and most of the flashing options were designed for low-slope or pitched shingle roofs. Over the past two decades, TDDs grew to rival and eventually surpass traditional skylights for residential applications.

Building on the success in the residential market, the first commercial-grade TDD appeared in the year 2000. This new technology featured a 21-inch-diameter tube and a transition box for a grid-ceiling system. The transition box allowed a round tube to accommodate a square diffuser simply by replacing a 2-foot by 2-foot ceiling tile. Open-ceiling models also debuted at the same time and featured a diffuser lens attached directly to the tube bottom. As a result, the approach to daylighting commercial buildings was simplified and the daylight-fixture concept was born.

Unlike windows and traditional skylights, the new commercial TDDs were not dependent on building orientation for light capture. With light levels being equal, the new TDDs significantly reduced the amount of heat transferred into the space, compared with electric light sources or other daylighting methods. They also reduced concern over glare, direct sunlight, and shifting patterns of light.

Currently, TDDs for commercial applications range from 10-inch-diameter units for small corridors and single-occupancy restrooms to a 29-inch-diameter size for large high-bay, high-volume spaces such as manufacturing, warehouses, convention centers, and big-box retail stores. There are flashings or curb-mounted options to address virtually any roof system.

Myth 2: Tubular daylighting devices are only for the top floor. Specular reflectance, which refers to a concentrated bundle of light transferred down the tube through the diffuser, is the key factor in determining how effective a TDD is at delivering light to an interior. It is often confused with total reflectance, which refers to scattered light that is reflected in every direction. Total reflection is not an indicator of throughput because it includes light that reflects back up the tube.

When daylight moves through a TDD, it reflects (bounces) off the tubing surface. With each bounce, a small amount of that light is lost. The higher the specular reflectance of the tubing material the lower the amount of light that is lost with each bounce down the tubing. Specular reflectance is the driving characteristic of light transfer efficiency (LTE)—the amount of light that travels through the tubing daily and seasonally. A system with a high LTE will have higher throughput and will deliver more light into the space.

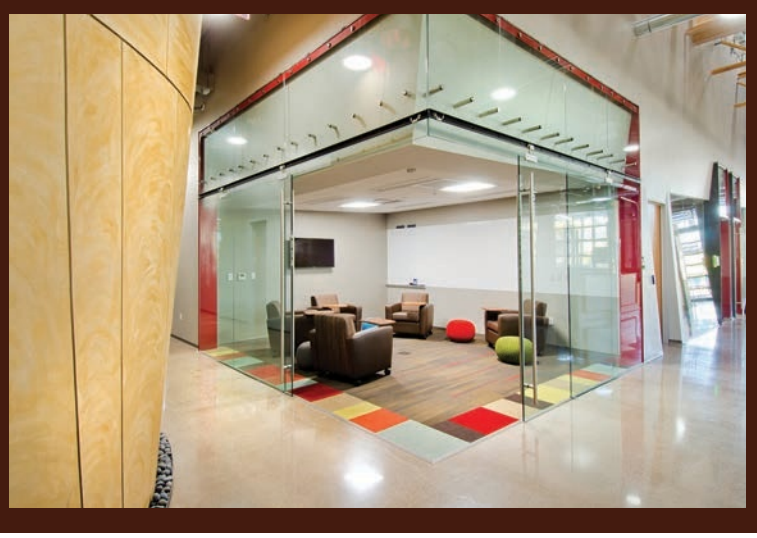
Some manufacturers offer tubing material made of a multilayer polymeric film to maximize LTE. This film reflects only the visible spectrum of light and

Prismatic diffusers are used in the stairwell area of the Pali Momi Medical Pavilion in Honolulu, HI. The round lights surrounding the perimeter are electric lights, not TDD units.

has specular reflectance greater than 99%. In ideal circumstances, the seasonal variation of this tubing from winter to summer can be as low as 11%. For tubing materials such as enhanced silver, which has a specular reflectance of 97%, the variance in light output is 36% or more from winter to summer, based solely on the tubing's specular reflectance.

Looking at the percentage of light delivered for a given length, the number of bounces, or reflections, it takes a light ray to get down the tube is a factor determined by solar angle and tube length. To create a true comparison of throughput, factor out dome optics and focus on tubing reflectivity. The results for different tubing materials can be quite dramatic. For instance, assuming ten bounces down a 10-foot tube run, a product that uses tubing with a multilayer polymeric film would deliver 97% of the light into the space, only losing 3% to reflection.

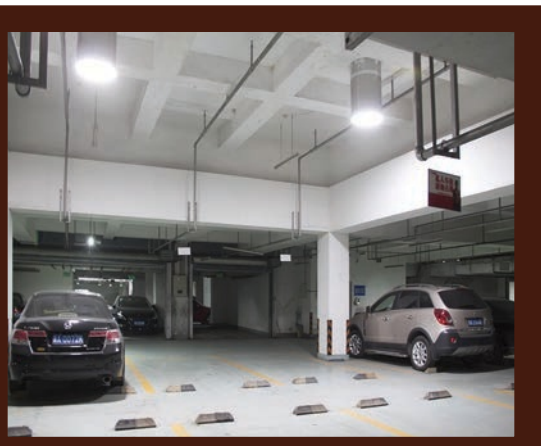
However, a product with enhanced silver tubing would deliver only 74% of the light into the space, losing 26% of the light to reflection. The numbers decrease exponentially with materials with lower specular reflectance or with flexible-tubing systems that have corrugations inside the tubing that may cause light to be redirected back up the tube. This means that larger diameter TDDs, using rigid tubing with multilayer polymeric films, can transfer light long distances with minimal light loss. In some cases, tube runs approaching 100 feet have been achieved. The multilayer polymeric-film tubing material also allows significant



▲ *Nearly half the electricity in a typical office is used for lighting. The use of TDDs at DPR Construction's Phoenix office capitalizes on the energy savings possible from the devices. In addition, human performance benefits such as enhanced worker productivity, increased retention, and reduced absenteeism are said to be additional benefits of daylighting.*

◀ *Fresnel-lens technology, as used at the Jefferson Middle School in Oceanside, CA, offers a high, wide-angle light spread so light is spread further up the walls and closer to the ceiling. Note the color of the sky reflected in the tubing.*

◀ *DPR Construction's LEED-NC Platinum net-zero energy office in Phoenix incorporates tubular daylighting devices as part of its energy-saving design. The open-office environment houses 58 workstations, conference and training rooms, support spaces, gym/locker facilities, and a Zen room for a quiet retreat.*



TDDs are not just for the top floors of structures as illustrated by the Hangzhou JHNY parking garage in China. Tube runs can span multiple floors, run down chases in the walls, and use multiple 90-degree turns to bring daylight deep into the interior in multistory buildings.

What To Consider

Make sure to select a product that meets the needs of the space. Most TDD manufacturers offer a range of models and component options to create the right configuration for the specific application and climate. For instance, if daylighting a large warehouse space, a TDD with a large diameter designed for high-bay applications is the best option, along with a diffuser lens that delivers maximum light to the work floor and a dome that maximizes high-angle sunlight. However, when designing for an office or classroom environment, select a TDD with dome optics that provides consistency in light levels throughout the day. In addition, you might opt for a diffuser that uses Fresnel-lens technology and offers a high, wide-angle light spread so light gets further up the walls and closer to the ceiling. For colder climates, explore insulation options at the roof level to reduce the potential for condensation.

Although product performance is crucial in TDD selection, the aesthetics of the space may be a priority. The goal may not be to achieve full daylighting so that the electric lights can be turned off completely. The motivation may be to add ambient daylight to a space to bring out interior colors and integrate seamlessly with the electric lights. In that case, the product selection may be driven by which manufacturer offers the best interior diffuser or decorative fixture options. In other instances, the goal may be to use TDDs to help balance the daylight coming in from another source such as a window or translucent wall system. A recent trend has been to use TDDs to create a wall-wash effect or to light a decorative ceiling fixture from above. For these applications, TDDs can be the light source that operates in the background and may not even be visible to the occupants.

Once a manufacturer is selected, make sure there is a factory-trained distributor or representative to assist with the project. Most TDD manufacturers will have a partner who works at a local level from project conception through completion to help meet daylighting goals and stay within the budget. These partners typically offer installation services in addition to training for subcontractors.

angles. For each 90-degree turn, approximately 5% of the light is lost. This can result in tube runs spanning multiple floors, running down chases in the walls, and using multiple 90-degree turns to be able to daylight deep into the interiors of multistory buildings.

Myth 3: Tubular daylighting devices are only effective at certain times of the day or year. Besides specular reflectance and LTE, other factors affecting seasonal consistency are a combination of dome optics, spectral selectivity, color temperature maintenance (CTM), and solar heat gain. Lower-end TDDs will have a greater daily and seasonal variation due to a lack of these properties. This means they will have minimal light input at low sun angles, the tubing will create significant light loss and color shift, and heat gain could be significant during summer months.

Advanced TDDs offer daily and seasonal consistency by incorporating dome technologies with passive internal reflectors or Fresnel-lens optics to efficiently collect low-angle sunlight. This can increase performance in the early morning, late day, and during the winter months when the sun is low in the sky, an especially important consideration in northern latitudes. Some dome technologies include Fresnel-lens optics that limit high-angle sunlight and heat. This creates more consistent light levels during midday, especially in the summer months, offering improved visual and thermal comfort to occupants. Most systems will also offer thermal breaks between roof components and the tubing so heat is not conducted into the space.

In addition, reflective tubing using multilayer polymeric film is spectrally neutral, meaning its spectral reflectance is consistently high for all wavelengths of visible light. In other words, it won't shift the color of the light that it reflects. It also has a high CTM, which measures how well a system can deliver reflected light without a color shift. This ensures that the true color temperature of the outside light is transferred into the interior space without compromise, providing near-perfect color rendition of interior surfaces. One of the best indicators of minimal color shift in a tubing system is to reference the LAB color model, a system for comparing the color consistency from a reflective material.

Heat gain is another crucial consideration, especially during warm summer months. A system's solar heat gain coefficient (SHGC) indicates how well that product blocks heat from the sun, a factor that can affect the thermal load of the building and air-conditioning usage. TDDs using metalized reflective material, such as enhanced silver, can have a high transfer of solar heat gain through the tubing system, increasing the thermal load inside the space. If the tubing system uses a multilayer polymeric film that is spectrally selective, focusing on the visible spectrum of light (400 to 760 nanometers), it can significantly reduce transmission of infrared wavelengths, the main culprit of solar heat gain. Combine this with Fresnel-lens optics in the dome that reject overwhelming midday sun and heat, and the result is a light-to-solar-heat-gain ratio that is unparalleled.

Myth 4: Tubular daylighting devices are unpredictable. While dome optics and tubing material play a major role in the predictability and consistency of a TDD, one must also take into account the overall design. Even the most advanced TDDs can be designed incorrectly for a space. If too many units are used, the results can be overwhelming; too few can yield disappointing results.

How does one determine the proper configuration, quantity, and spacing of TDDs for a given area? The answer is relative photometry. Most reputable TDD manufacturers offer some sort of photometry that predicts light output for a single point in time or on an annualized basis. The photometric data should be developed by an independent third party and be specific to the model and options you are selecting, as well as the geographic location of the project. Some manufacturers use proprietary design calculators that have built-in weather data and can be used to produce very accurate light studies, given room dimensions, geographic location, and hours of occupancy. Look for a manufacturer who can offer this type of assistance either directly or through trained daylighting experts.

Tied closely to predictability is the notion of controllability. Most TDD manufacturers offer daylight dimming devices that give users total control over the amount of daylight entering the space. Some models use a wall switch to control a butterfly baffle inside the system that modulates the amount of daylight. Other models use a single-disk dimmer design. However, in a partially closed position these designs may create inconsistent shadows on the interior space. For best results, a dimmer that uses a butterfly baffle that can stop at various positions, rather than just in on or off positions, is recommended for consistent light distribution.

Myth 5: All tubular daylighting devices are the same. Factors such as dome optics, spectral selectivity, color temperature maintenance, and solar heat gain affect consistency and vary from manufacturer to manufacturer. Significant differences exist in the product offerings of TDD makers. Some specialize in TDDs while others only offer TDDs as a small part of their overall product line. Thoroughly research manufacturers before starting the product-selection process. Don't accept substitutions once you select a product unless proof is provided it can meet the initial design intent. Respect the spec. BP

AUTHOR

Michael Sather is the commercial marketing manager at Solatube International Inc., Vista, CA.

Perforated metal panels give The Summit recreation facility needed shade and additional architectural presence. *Photo credit: Charles Davis Smith c/o Brinkley Sargent Architects, Dallas.*

Canopy and column panels form a trellis effect along with providing glare relief and shade.

Metal Makes The Shade

Perforated metal canopies cut glare and provide shade while reducing the electric bill for a recreation facility.

The Summit, Grand Prairie, TX, is an active-adult center that provides areas for fitness, recreation, and entertainment. Built diagonally on its site, the 57,000-sq.-ft. building features an expanse of glass on the northwest side to maximize a lake view and fountain. With summer temperatures in the mid-90s, the accumulated solar heat could have a substantial impact on the power bill. The building was an ideal candidate for a solar-shade system.

The system needed strategically placed horizontal and vertical forms to reduce heat and glare, yet complement the building's contemporary-Craftsman style. With energy efficiency as a goal, the plan was to achieve a shadow over the northwest facade at the sun's highest point of the year, and to maintain the shadow as late in the day as possible to control the heat load based on solar angles. In addition to the solar concern, the design team had to consider the nature of the activities at The Summit. Also open at night, the facility design incorporates decorative lighting, so the material applied to the structure needed to complement the lighting.

Designed by Dallas-based Brinkley Sargent Architects, the building's solar orientation created a challenging design task. According to Stephen Springs, AIA, project manager with Brinkley Sargent, "When it comes to solar impact, this was one of the most challenging projects we have been involved in." A large amount of glass and a harsh solar exposure meant the shade devices had to be large.

The design team created a series of exterior canopies with height and width to cast a significant shadow. Using material from McNichols Co., Tampa, FL, perforated metal panels cover a majority of the visible surface material for the shades. The structures, many as much as two stories in height and 23 feet wide, give the building a light and airy appearance.

Similar perforated products were applied to the canopy's support columns, transforming the frame steel pillars, set approximately 4 feet apart, into a simulated trellis able to achieve air circulation and light transmission. The column/trellis look is repeated on the building's south side, where columns vertically transect the windows while supporting the canopy overhanging the roof.

More than 11,000 sq. ft. of 1,000 individual perforated panels were applied. Panel size ranges from 3 1/2 by 4 feet to 3 1/2 feet by 1 foot.

To install the panels, Johnston Products of Dallas drilled figure-eight keyholes at various points along the smooth-framed edge, hanging the panels on pin heads welded to the channel steel column. This allows panels to be removed for cleaning and maintaining the lighting system positioned within the trellis.

The assembly of metal features is secured to the LEED Gold building with minimal welding, joined instead with bolted connections on the canopy and by a series of steel bands and bolts on the vertical columns. In another variation on the design theme, the perforated metal panels atop the canopy are curved on a slight radius and installed at a 45-degree angle, adding another dimension to the aesthetics and a practical means of reinforcing the material. cbp

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Inspired by close-up photos of plants, the VanDusen Botanical Garden Visitor Centre pushes design boundaries using sustainable materials, along with Alucobond aluminum composite material, to make the roof come alive.
Photo courtesy Vancouver Board of Parks and Recreation

Downtown Garden Blooms With Aluminum

When design of the VanDusen Botanical Garden Visitor Centre was awarded to Perkins+Will Canada, Vancouver, architects were challenged to create a building that not only would increase visibility for and attract more visitors to the 54-acre internationally recognized garden in downtown Vancouver, British Columbia, but also meet the highest goals in sustainable-building design.

The $21.9 million (Canadian), one-story, 19,000-sq.-ft. visitor center houses a café, library, volunteer facilities, a garden shop, office space, and flexible classroom spaces within an iconic design reflective of the organic forms and natural systems of a native orchid. Submitted for LEED New Construction v 1.0 Platinum status, the visitor center also will vie for recognition in the International Living Future Institute's (Portland, OR) Living Building Challenge—the most stringent measurement of sustainability in the built environment. The visitor center serves as a public face for the City of Vancouver's initiative to be the greenest city in the world by 2020.

"We worked in a design charrette that included members of the Vancouver Board of Parks and Recreation, user communities, and volunteers to determine their needs and wants," said Harley Grusko, IA-AAA, LEED AP BD+Cah, architectural designer, Perkins+Will Canada. "One of their goals was to triple visitorship. They wanted architecture that would enable more visibility, because the existing buildings for the garden entry were hidden from the road by trees. From our perspective, we wanted to give them something iconic. Keeping in mind the garden setting and the group's bold desires, we looked for inspiration to guide this project to make it iconic and as sustainable as possible."

Alucobond bends and flows to add distinction and sustainability to a botanical garden.

The building's unique orchid design was developed in collaboration with Cornelia Hahn Oberlander, a premiere Canadian landscape architect based in Vancouver. Grusko and Oberlander were inspired by the close-up plant images of German photographer Karl Blossfeldt (1865-1932). "We both were captivated by his image of an orchid," said Grusko. "We were inspired by its quite curvaceous form and its meaning in relation to this project's sustainability goals. A flower captures energy from the sun and doesn't produce waste."

Growing from an architectural oculus, the orchid design was achieved with "undulating green roof 'petals' that float above rammed earth and concrete walls," according to an architect's statement. "These petals and stems are connected by a vegetated land ramp that links the roof to the ground plane, encouraging use by local fauna."

To meet Living Building Challenge standards, the project used only building products that did not contain red-list chemicals. Materials included fully recyclable Alucobond aluminum composite material (ACM) from 3A Composites USA, Statesville, NC; wood; glass; and rammed earth.

"It's a shift in thinking in how to design buildings with materials that appear more raw-like in nature, so we limited our material palette," said Grusko. "We wanted raw aesthetics. In terms of its visual presence, the Alucobond offered the look of raw aluminum that attracted us. We wanted aluminum for the roof edge because we knew it was going to capture the eye. The detail around the perimeter of the roof was extremely important. We needed to find a material that could bend in a couple of directions at the same time. We also needed a fabricator who was willing to try to do this."

Green roof "petals" float above rammed earth and concrete walls and are connected by a vegetated land ramp that links the roof to the ground plane. The visitor center uses Alucobond ACM to give roof lines an undulating look.
Photo courtesy Keith Panel Systems

Keith Panel Systems (KPS) Co. Ltd., Vancouver, fabricated and installed approximately 12,000 sq. ft. of Alucobond naturAL in a custom plain-mill finish and 4-mm thickness on the roof of the VanDusen Centre with a custom KPS attachment system. Alucobond naturAL aluminum composite material has a finely textured aluminum surface with a FEVE clear coat and consists of two sheets of 0.020-inch aluminum, thermobonded to a polyethylene

core. Alucobond provides flatness and rigidity, formability, low weight, and weather resistance. Five of the orchid-design "petals" feature Alucobond, including one unique petal that starts out as the roof and then dramatically drops downward in a half-barrel shape to the ground.

"Our challenge was not to make art out of metal but to cover art (the building) with metal and maintain its shape," said Doug Dalzell, general manager, KPS. "The building was made out of wood that could be shaped and glued to assist in creating all of these forms. We used our technology, CAD software, and shop equipment to develop an understanding of this building's form. A decision was made that Alucobond would be the best material to achieve this three-dimensional challenge. We've done more than 3,000 projects with Alucobond and know that it can be 'alive.' The material had to go up and down and sideways at the same time to achieve these undulating roof lines. There are both positive and negative curves in this design."

KPS not only created detailed shop drawings to reflect the patterning of the Alucobond on the roof but also built a 30-foot model of the building featuring its "most radical" parts, according to Dalzell. "We were confident that we could approach this challenge properly to help create these roof edges," he said.

While a great deal of time and effort was involved in creating shop drawings and modeling the roof, architectural changes still had to be addressed by KPS employees on site during Alucobond installation. "The biggest challenge for KPS had to be dealing with changes as we went along," said Grusko. "One of the last materials installed on this building was the Alucobond. A great deal of the finished profile of the roof was in KPS' hands. In the end, they had to do a lot of re-measuring and site work. One of the great things about KPS is the company's continued interest in innovation. They want to create unique products to showcase their work."

The VanDusen Botanical Garden Visitor Centre was awarded a 2012 Lieutenant Governor Merit Award from the Architecture Institute of British Columbia and a 2012 Lieutenant Governor's Award for Engineering Excellence from the Association of Consulting Engineering Companies-British Columbia.

"The response to this building has been quite overwhelming," said Grusko. "We've been hearing a lot of great things. The Alucobond helped us to push the boundaries of our design ambitions. We had a great experience with Alucobond. I'd certainly use it again." CBD

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Hygard Sentinel:

- Blast/ballistic-resistant façade
- Department of State certified
- Can be added to existing buildings

High-performance, blast-protection façade

Hygard Sentinel blast-, ballistic-, and forced-entry-resistant façade system can be adapted for specific project requirements to protect critically important buildings and other structures. Hygard BL80 and BL80-GC8 are certified against a 15-minute, simulated forced-entry assault. The latter also meets the Department of State's high-level ballistics-resistance requirements. The system provides attractive, yet practical, design possibilities with high light transmission and good thermal management. The façade system can be added to existing buildings. It combines the aesthetics and impact resistance of Hygard polycarbonate laminate panels with a high-strength, energy-absorbing steel mounting structure.

Bayer MaterialScience
Pittsburgh
Free information: Circle 96

Wall-cavity filler

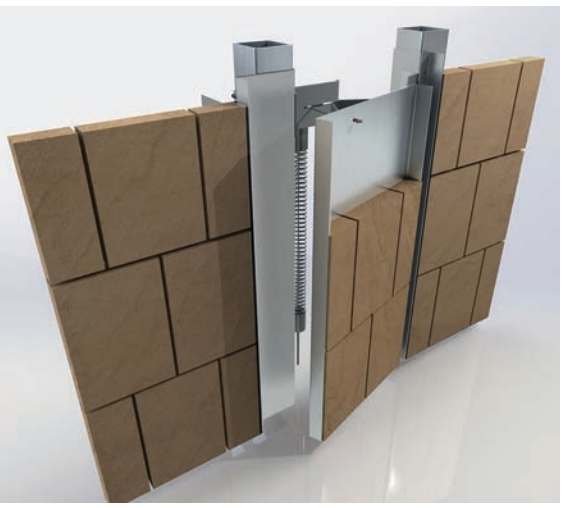
Handi-Fill wall seal is powered by High Flow Technology, a pour-in-place system that fills wall voids with an air seal that is said to not shrink over time. According to the company, the product fills existing wall cavities that have little-to-no existing insulation and offers an increased R-value of 3.4/inch and an air seal, without needing to remove drywall. The material can be identified during installation with a thermal-imaging camera. The material is reported to be stable and will not settle or shrink over time.

Comfort RX
Norton, OH
Free information: Circle 97

Factory-applied reflective surface

Sunburst mineral surfacing is available as a factory-applied option on select StressPly roof membranes for one-step installation of waterproofing and reflective surfacing. The surface meets California Title 24, uses CRRC-listed products, and is said to exceed the SRI LEED requirement by almost 20%.

The Garland Co. Inc.
Cleveland
Free information: Circle 98



Expansion joint

JointMaster 601 Stealth expansion-joint system for wall-to-wall or wall-to-corner exteriors reportedly can be hidden on any building regardless of the façade material. The joint can be in-filled with material, including precast concrete, wood, stone, brick, marble, slate, and glass, to reduce its sightlines to a few inches, but still handle seismic-grade movement.

InPro Corp.
Milwaukee
Free information: Circle 99

No-VOC stains

Sher-Wood WB-S spray stain and WB-W wiping stain are reported to contain no VOCs and have calculated VOCs of 0.0 pounds/gallon and 0.02 pounds/gallon, respectively. The products are available in a wide variety of colors and are said to work well with most topcoats. Both are water based.

Sherwin-Williams
Cleveland
Free information: Circle 100

Spray-foam insulation

The company's LD-R-50 castor-oil-based spray-foam insulation is applied without an ignition barrier on the floor. Exterior wall applications include Type I to IV, in addition to the product's existing approval for Type V exterior walls.

Icynene
Mississauga, Ontario
Free information: Circle 103

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Roof system

MR-24 standing-seam roof system has a 360-degree Pittsburgh double-lock seam and uses the Butler-Cote fluoropolymer finish system, said to be highly resistant to chalking, fading, and chipping. The system covers most types of existing roof material, including single-ply, foam, and modified-bitumen, and integrates into the aesthetics of existing facilities.

Butler Mfg
Kansas City, MO
Free information: Circle 101

Zinc finishes

Allusion print-coat system includes additional zinc finish options. The prefinished, print-coat system simulates natural finishes, including wood and specialty metals, using high-performance print-coating technology. Available finishes include blue zinc, red zinc, crystal zinc, and green zinc, along with light oak, dark oak, rust, slate, and antique bronze. Allusion can be applied to steel and aluminum substrates.

Centria
Moon Township, PA
Free information: Circle 102

In-wall power box

Wiremold Evolution series in-wall box provides power, communications, and audio/video to wall-mounted flat-screen monitors. Available in four-gang and two-gang versions, the box supports digital displays in applications such as conference and meeting rooms, and in education and medical settings. The box has removable device modules that support industry-standard device plates that can be detached and removed to facilitate moves, adds, and changes to service. The four-gang holds two device modules, the two-gang has one module with storage space for A/V components. All modules have a removable divider for separation of power and low-voltage service. The box installs in steel and wood stud walls. Integral tunnels on both sides of the device modules enable wire and cable to pass through.

Legrand
West Hartford, CT
Free information: Circle 82

Evolution in-wall box:

- **Provides power, communications, and A/V**
- **Removable device modules**
- **Installs in steel and wood stud walls**

Parking-garage fixture

The company's parking-garage fixture uses Smart bi-level technology, stepping down to 40% when an area is vacant for a set length of time. Upon occupancy, the fixture steps up to 100%. The product has enhanced optics, said to improve the unit's efficiency 30% and increase overall light distribution by 35%. The fixture has a 10-year warranty.

Everlast Lighting
Jackson, MI
Free information: Circle 83

Indirect LED fixtures

IW, IWTB, and IWS series luminaires are available with LED lamps. The indirect fixtures with an asymmetric lightwash provide vertical illumination in applications such as lighting a mirrored surface or a videoconference speaker where a shielded lamp is critical. The reflector is said to provide even, unscalloped illumination with no glare. The 2- and 4-foot units use two or four Sylvania 11-W, 3,500-K LED modules that are 80+ CRI.

Engineered Lighting Products
El Monte, CA
Free information: Circle 84

Rigid, linear LEDs

DL-RS series rigid, LED linear lighting strips provide high lumens and color rendition. With 18 LEDs/foot, the strips are available in a variety of white color temperatures from 2,700 K to 6,000 K. The fully dimmable luminaires are available in 12-, 24-, 36-, and 48-inch lengths for a maximum continuous run of 24 feet.

Jesco Lighting Group
Glendale, NY
Free information: Circle 85

Power track

PTRC3 power-track system delivers additional power from a wall to a workstation. Available in fixed 4- or 6-foot lengths or modular 3-foot sections from 9 to 24 feet, the thin profile lies nearly flat. The sections are said to be safe for casters, carts, and wheelchairs to smoothly pass.

Doug Mockett & Co.
Manhattan Beach, CA
Free information: Circle 86

Power pack

OPP20 Super Duty power pack includes a mechanically held 20-A latching relay and fail-safe circuitry to provide dependability and performance for all load

types. The line includes models for daylight harvesting, bi-level switching, ASHRAE 90.1 and CA Title 24 plug-load control requirements, occupancy-sensing control, and manual switching.
Leviton
Melville, NY
Free information: Circle 87

Crystal table lamp

Norma Jean crystal table lamp provides direct/indirect, ambient/accent lighting in an understated, colored-crystal design. The hand-blown, wine-decanter-shaped body has a weighted base and is available in wine red or chocolate. The lamp is 29-inches high and has a drum-shaped linen shade.
Coldstream Group Inc.
Mamaroneck, NY
Free information: Circle 88

Surgical-suite LED

MedMaster M4 LED surgical-suite luminaire has a one-piece, seam-welded housing with an antimicrobial finish. Lens uniformity is said to reduce glare. Several lens options are available. The fixture can be dimmed.
Kenall Lighting
Gurnee, IL
Free information: Circle 89

Industrial-look LEDs

Retro-industrial LED low-bay fixtures are available in 70-, 85-, and 110-W models and 6,600 to 10,500 lumens to replace 150- to 250-W metal halides. With a variety of color temperatures, the DesignLights Consortium-approved fixtures use die-cast aluminum and a non-glare, tempered safety glass.
YS Lighting
Trevose, PA
Free information: Circle 90

LED well light

LMWL LED micro-well landscape light has silicone O-rings and grommets to provide a hermetically sealed fixture, even in extreme conditions. Only 3 3/4 inches in diameter, the fixture has an interchangeable optic assembly that can be raised for uninhibited light distribution or regressed into the unit a full inch, hiding the light source. The eyeball-style luminaire allows the optic assembly to tilt 18 inches and rotate 360 degrees. The fixture is available in a wide variety of LED levels and optic widths.

Auroralight
Carlsbad, CA
Free information: Circle 91

Architectural pendant

Drake pendant has five double-stem luminaires mounted on a double-linear frame. The 6 1/2-inch-tall, 60-W candelabra lamps have a frosted-glass diffuser. The luminaire is 29 1/2-inches high, 11-inches wide, and 49-inches long, and is available in a variety of finishes.

Ilex Architectural Lighting
East Taunton, MA
Free information: Circle 92

LED flush mount

Lithonia Lighting's 7-inch LED Versi Lite flush-mount luminaire is said to offer an 84% power reduction, compared with 60-W incandescent. Applications include hallways, utility closets, bathrooms, and work areas. Available in a wide range of color temperatures, it is dimmable using standard Triac dimmers.

Acuity Brands
Atlanta
Free information: Circle 93

Track lighting

Conix II LED Trac lighting includes four fixtures said to reduce energy consumption by as much as 20% when compared with ceramic metal-halide fixtures. Fixtures include the 19-W T261L, 24-W T262L, 33-W T263L, and 40-W T265L that provide outputs ranging from 1,000 to almost 2,800 lumens. They are available in four color temperatures and a variety of finishes.

Juno Lighting Group
Des Plaines, IL
Free information: Circle 94

Rotatable LED sconces

Uno and Vorti LED rotatable sconces provide aimable, diffused ambient/accent lighting as additions to the Twivell series. The Uno model is 15-inches long; Vorti is 25 inches. Several finishes are available. Components rotate to 350 degrees and are dimmable.

Nessen Lighting
Mamaroneck, NY
Free information: Circle 95

MDF door line

Creating the illusion of stile-and-rail construction, the company's MDF door line is manufactured reportedly with the strength and stability of one-piece, solid-panel construction to provide a blank canvas for user-specified design and project requirements. An additional door line is made from the same composite materials as solid-panel doors but is fabricated piece by piece with mortise-and-tenon joinery as a true stile-and-rail door. Doors are primed and ready to paint or factory painted based on color choice and are available with fire ratings from 20 to 90 minutes, in neutral- or positive-pressure construction.

Masonite Architectural Door Systems
Tampa, FL
Free information: Circle 104

EDITORS' CHOICE

MDF doors:

- **User-specified design and project requirements**
- **Primed or factory painted**
- **Fire ratings from 20 to 90 minutes**

Fiberglass windows

The company offers a complete line of fully rated fiberglass windows. With IG thicknesses to 1 11/16 inches, DP ratings of 100, a wide variety of installation accessories, and a range of colors, the window systems are said to meet and exceed every commercial window requirement. The company also manufactures insulated glass that provides extremely low U-values for thermal performance.

Armaclad Windows and Doors
Chicago
Free information: Circle 105

High-performing substrate

GraphiteBlue glass is a light blue-gray and allows high levels of visible light transmission, along with low interior and exterior reflexivity. Used with the company's low-e coatings, it provides solar control and reduced glare. It can be incorporated into insulating glass units, laminated make-ups, or used monolithically. Available in 1/4-, 5/16-, and 3/8-inch thicknesses, it can be heat treated.

Viracon Inc.
Owatonna, MN
Free information: Circle 106

Insulated steel door

Stormtite AP model 627 insulated rolling steel door has a 10.9 R value and 0.09 U value. Exterior and interior EPDM triple-finned, guide-brush weather seals, along with hood, bottom bar, and lintel weather seals diminish air leakage around the perimeter. The door provides a wind-load protection of 20 psf and can be custom built to accommodate high wind loads. The doors have interlocking slats with end locks and/or wind locks that provide resistance against forced exterior entry.

Overhead Door Corp.
Lewisville, TX
Free information: Circle 107

Low-e glass

SunGuard Neutral 78/65 low-e glass coating provides high visible light, high solar-heat gain, and a neutral color. Applications include cooler climates where passive heat gain is desired. The product can be used in double- or triple-glazed units, and in combination with the line's low-e coatings.

Guardian Industries
Auburn Hills, MI
Free information: Circle 108

Hurricane protection

The company's head, jamb, door-bottom, and threshold gaskets are said to eliminate wind-driven water infiltration. Gaskets are available as mill or clear anodized-aluminum housings with neoprene rubber inserts. Cam-lift hinges are available in stainless steel.

Zero International
Bronx, NY
Free information: Circle 109

Mobile programmer

Logic and M3 Logic remote key-programming devices allow administrators to update credentials using a mobile phone connection. The units provide enhanced accountability through uploading audit-trail data

without the need to recall keys. Used with the Logic web-manager system, the units are said to make a system more secure by creating a dual-authentication requirement for access.

Medeco
Salem, VA
Free information: Circle 110

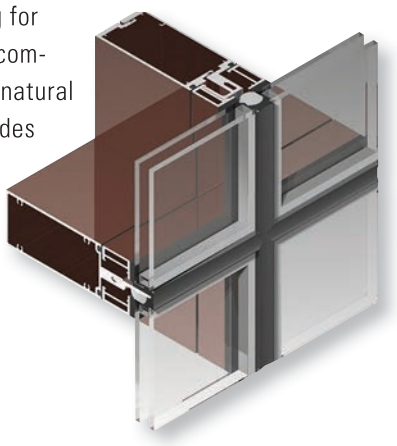
Energy-performance windows

The 4500 series windows for hospitality, multi-family, and mixed-use projects include fixed and tilt-turn windows, tilt and slide doors, and outswing-hinged doors. The uPVC products are said to provide energy efficiency, occupant safety, low maintenance, and longevity. North American and European frame styles are available. One-inch insulated glass is standard with triple pane available. Several colors and finishes are available.

Kolbe Windows & Doors
Wausau, WI
Free information: Circle 111

Silicone-glazed system

SuperWall SSG, for four-side, silicone-glazed curtainwall and window wall systems, is available in four depths (6 3/4, 7 3/4, 8 3/4, and 10 3/4 inches) and accepts standard, structural silicone, insulating glass units. Narrow 2 1/2-inch mullions are matched by inside and outside 90-degree corner profiles to maximize the opening for daylight and views. Product framing accommodates zero-sightline insert vents for natural ventilation, ClearStory exterior sun shades and interior light shelves for daylight optimization, and façade-integrated photovoltaic modules for renewable energy generation.



Wausau Window and Wall Systems
Wausau, WI
Free information: Circle 112

Estimating software

Ycalc X5 software provides project estimation, preliminary structural design, shop drawings, material optimization/take-off, and fabrication utilities. Powered by Logikal, the software includes products from the company's enerGfacade and ProTek lines.

YKK AP America
Austell, GA
Free information: Circle 113

Packaged ventilation system

Airedale ClassMate single-packaged, vertical DX and heat-pump system is said to provide efficiency and quiet operation in a small footprint. Applications include school installations. Offered in four capacities from 24 to 60 MBH and two cabinet sizes, the system uses the company's CF microchannel evaporator coil. The smaller coil allows space for supplemental heat exchangers such as a hot-gas reheat coil, hot-water coil, or electric heat elements to be factory installed in the unit. The compact system does not require a plenum. Other system features include modulating, electronically commutated fan motors; front access to all components; R410a refrigerant; and modulating economizer damper for 100% free-cooling and fresh-air requirements.

Modine Mfg Co.
Racine, WI
Free information: Circle 65

Airedale ClassMate:

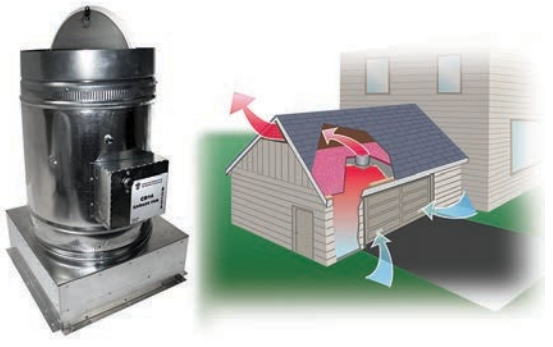
- **Vertical DX and heat-pump system**
- **24 to 60 MBH**
- **Needs no plenum**

EDITORS' CHOICE

Seismic/wind-load-rated bases

Seismic/wind-load-rated bases, for secured rooftop mounting of equipment, are manufactured to IBC/ASCE7-rated requirements. Options include built-in roof pitch, additional height, built-in filters or sound traps, and a pressure-treated wood nailer. Bases are all-welded construction and are shipped in one piece if possible.

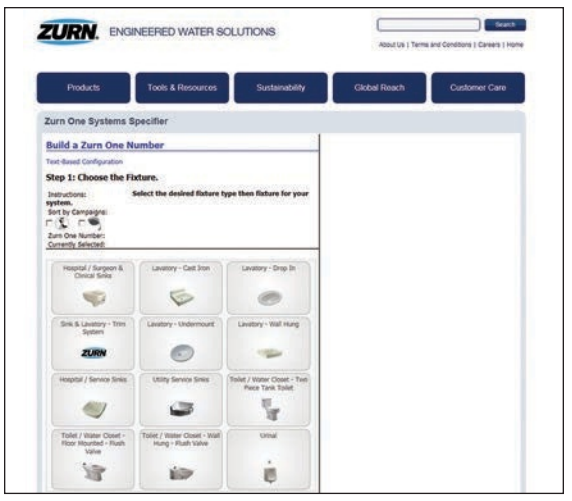
Thybar Corp.
Addison, IL
Free information: Circle 66



Garage ventilation

Cool Breeze garage fan provides air circulation to reduce temperature throughout a garage interior. Mounted between ceiling joists, the fan pulls hot air from the ceiling area and exhausts it into the garage attic space to exit through the ridge, roof, or gable vents. The fan has a 16-inch-wide intake plenum and a 1,200-cfm motor and includes an automatic fire damper for building-code compliance.

Tjernlund Products Inc.
White Bear Lake, MN
Free information: Circle 67



On-line plumbing tool

One System Specifier is a web application that configures a project's plumbing components to meet customized specifications. Built-in logic selects, manages, and tracks the company's products. The user is shown product choices that are feasible for the type of system being configured. Selections can be saved, tagged, and bookmarked. The entire system is given a single part number and shipping order, providing an all-in-one-box solution.

Zurn Industries
Erie, PA
Free information: Circle 68

Cooling-based dehumidification

FreeDry unit combines cooling-based dehumidification with a low-temperature desiccant rotor for moisture removal and a reported 60% lower annual operating cost. The unit uses the waste heat from a facility's ice plant to maintain indoor humidity levels, even under extreme summer conditions.

Munters
Selma, TX
Free information: Circle 69

BIM products

BlazeMaster fire-sprinkler systems are a recent addition to the products that the company offers in BIM software. FlowGuard gold pipe and fittings and Corzan piping systems are also available for BIM. The software provides creation and management of infrastructure projects. The non-metallic pipe and fittings meet requirements for hot and cold potable water.

Lubrizol Corp.
Cleveland
Free information: Circle 70

Solar thermal storage tank

Strato-Therm+ solar thermal storage tank provides a solar thermal storage tank, indirect water heater, and hydronic buffer tank in a single unit. The unit stratifies the hydronic heating water stored in the tank. As solar energy is added to the copper-tube spherical heat exchanger, heat is introduced to the stored water. The heated water rises to the top. The tank is available in nine models from 125 to 900 gallons.

Lochinvar
Lebanon, TN
Free information: Circle 71

Response codes

Quick response (QR) codes are part of the product labels on the company's control and air-measuring and life-safety dampers. When the code is scanned with a smartphone, it links to the company's website page for that model, providing instant access to a variety of information including product specifications, instruction manuals, and warranty information.

Greenheck
Schofield, WI
Free information: Circle 72

Integrated controls

SmartME zone controller, AdvancedHVAC input/output controller, and the EB-50GU-A central controller work together as a comprehensive system to support enhanced functions, including dual set-point and set-back, maintenance data storage, and energy-management monitoring. The controls allow users to monitor and operate City Multi VRF zoning systems and third-party equipment through M-Net. The controls also function individually.

Mitsubishi Electric Cooling & Heating
Suwanee, GA
Free information: Circle 73

Propane energy system

Model CP5WN propane-fueled, high-efficiency, 5 KW, micro-CHP combined heat and power system reportedly can significantly reduce energy consumption for structures as large as 8,000 sq. ft. Working in conjunction with an existing energy system such as a forced-air furnace or boiler, the system uses the waste heat produced during the production of electricity so less fuel is needed to power a facility. The system generates electrical power on location.

Yanmar America Corp.
Adairsville, GA
Free information: Circle 74

UV-light system

Stinger UV-C fixture destroys surface microbes and organic materials that impede HVAC system efficiency and contribute to allergies and poor indoor-air quality. The low-voltage unit mounts from the exterior and requires no interior-unit access. Applications include hard-to-access equipment as large as 5 tons, including fan coils, heat pumps, unit ventilators, or individual duct runs.

UV Resources
Santa Clarita, CA
Free information: Circle 75

Condensing tankless water heater

Greentherm C 1050 ES and C950 ES are Energy Star-rated, condensing gas-fired tankless water heaters. The wall-mount units have multiple venting options, and as many as four unit cascades can be vented together through a sidewall or roof. The Therm C 1210 ESC unit can be cascaded, using as many as 24 units, to provide 240 gallons/minute and is available in natural gas and liquid-propane models.

Bosch
Londonderry, NH
Free information: Circle 76

Rooftop ducting and support

SlimDuct RD series and PD series rooftop ducting and support systems for multiple linesets are said to save more than 75% in labor when compared with custom sheet-metal lineset ducting or other fabrications. The RD series uses 20-gauge, roll-formed, rectangular sheet metal with a chromium-free ZAM coating. Sev-

eral widths are available. The PD series for smaller installations also serves as a transition to protect the lineset from where it exits the VRF condenser.
RectorSeal Corp.
Houston
Free information: Circle 77

Air-cooled chillers

The company's modular chillers range from 20 to 85 tons and, when combined, provide bank capacities as high as 1,000 tons. The units use scroll and screw-compressor technology and environmentally friendly refrigerant to provide high performance and meet LEED criteria. All models are said to be maneuverable through standard doorways while occupying a minimal footprint. Models UCA 020, 030, and 070 are AHRI Certified.
ClimaCool Corp.
Oklahoma City
Free information: Circle 78

Rooftop units

Energence 20- to 30-ton rooftop units are available in 20-ton gas/electric and electric/electric VAV models and 25- and 30-ton gas/electric and electric/electric CAV and VAV models. All use the Prodigy unit controller, SmartWire system, and Environ condenser-coil system.
Lennox Industries Inc.
Dallas
Free information: Circle 79

Dual-flush, hands-free valve

Selectronic dual-flush, hands-free toilet valve automatically adjusts water-volume usage, reportedly conserving 0.44 gallons when compared with a standard 1.6 gpf. The valve provides hygienic operation, has a self-cleaning piston that helps prevent clogging and reduces maintenance, a manual override, and fail-safe operation that causes the valve to close automatically and stay closed upon loss of power or water pressure.
American Standard
Piscataway, NJ
Free information: Circle 80

Variable-speed circulator

HEC-2 Bumble Bee high-efficiency, variable-speed circulator is a wet-rotor circulator said to use 85% less electricity than a standard circulator. The device determines the flow required to match ever-changing building heat loads and can reduce boiler short cycling. Pre-set to run in Delta-T mode, it can be programmed for variable-speed setpoint operation to maintain a fixed supply temperature or dialed-in to one of four fixed speeds. An integral flow check and two plug-in remote temperature sensors are included.

Taco
Cranston, RI
Free information: Circle 81

Intelligent notification appliances

TrueAlert ES family of intelligent notification appliances is said to provide better protection, maximum ease of use, and lower operating costs than conventional technology. An addition to the company's line of web-enabled eService solutions, each device is electronically supervised, built with the intelligence to continuously report its status to the company's 4100ES fire-alarm control panel. Devices include a self-testing capability. A pass-fail signal is sent to the control panel when audible and visible devices are tested. Information and test history are stored, and the panel can generate reports for AHJs. A warning alert is provided when repair or maintenance is needed.

SimplexGrinnell
Westminster, MA
Free information: Circle 58

TrueAlert ES:

- **Web-enabled, eService notification solution**
- **Reports to 4100ES fire-alarm control panel**
- **Self-testing capability**

Cloud-based energy management

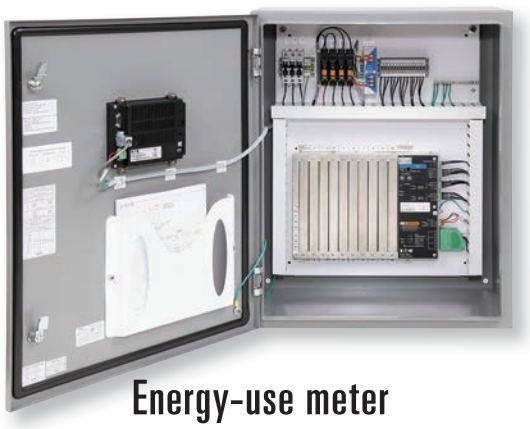
EcoCentral Virtual Engineer is a cloud-based energy-management command center. Integrated with the EcoSmart suite of wireless networked products, the software provides a building-control platform with 24/7 remote-monitoring services. Buildings, zones, rooms, or individual devices can be controlled in real time. The Floor Planner feature visualizes facility data points to view energy savings by floor and size of building. Users can facilitate intelligent load-shed actions and enable logical profile shifting.

Telkonet Inc.
Milwaukee
Free information: Circle 59

Security management

AnyWare browser-based access-control solution runs on smart phones and tablets. The plug-and-play product uses an IT-friendly network appliance and is said to be ready to configure in a matter of minutes when used with the company's IP-ready 1700 controllers.

Sielox
Runnemede, NJ
Free information: Circle 60



Energy-use meter

Power Xpert multi-point meter tracks facility energy use. For multi-tenant applications, the meter provides property managers and building owners a solution for quantifying, benchmarking, and allocating energy use. The meter also aggregates gas, water, and steam consumption data to allow a comprehensive review of a facilities' utility use for energy-saving solutions. For new and retrofit applications, when mounted in a panelboard or switchboard, the meter provides an integrated, scalable power-distribution and energy-metering solution. A single device is said to handle 20 three-phase or 60 single-phase circuits and is compatible with most low-voltage systems.

Eaton
Cleveland
Free information: Circle 61

Custom roof hatches

Type D double-leaf roof hatch features a large opening that allows equipment to be installed or removed from a building. Hatches are custom fabricated to meet virtually any access-opening requirement. Designed for weather-tight performance and safe and easy operation, hatches have full EPDM gasketing, insulated covers and curb, and an overlapping cover design. Each has a lift assist that is engineered to the cover size and weight to allow one-hand operation.

The Bilco Co.
New Haven, CT
Free information: Circle 62

Control processors

DIN-AP3 and DIN-AP3MEX 3 series control processors, designed for DIN rail mounting, provide wired or wireless control, respectively. The control systems are said to provide an increase in processing power and speed. Modular-programming architecture allows as many as ten programs to run independently and communicate with each other on one platform. The processors work with DALI ballasts and LED drivers.

Crestron
Rockleigh, NJ
Free information: Circle 63

Power-quality meters

ASCO 5400 series power-quality meters are said to capture every event that occurs in on-site power systems, no matter how fast or small. The meters use continuous, high-speed, wave-form recording and transient harmonic displays that allow capture of data on sags, swells, and other events. Data are tracked and stored on time-of-day energy consumption, flicker, crest, and K-factor. Events are aggregated and synchronized from multiple meters to the millisecond with ITIC compliance curves. Meters can capture data from gen-sets, utility mains, power-transfer switches, UPSs, paralleling gear, TVSS, PDUs, and critical-power distribution boards.

Emerson Network Power
Florham Park, NJ
Free information: Circle 64

Color-consistent grout

TEC TecniColor grout is said to resist many chemicals used in commercial applications and have permanent stain resistance with no sealing. The high-strength formula is also said to be crack and shrink resistant, along with resisting mold and mildew. The high-definition color resists UV fading and provides color consistency with no efflorescence. The product comes premixed and ensures color accuracy and uniformity with no inconsistencies due to variations in mixing methods or water sources. The material reportedly spreads smoothly to fill joints and cleans up easily from the tile surface using only water. The universal floor-and-wall formula can be used on joints from 1/16 inch to 1/2 inch. Eight colors include bright white, pearl, antique white, sandstone beige, light buff, DeLorean gray, summer wheat, and charcoal gray.

H.B. Fuller Construction Products Inc.
Aurora, IL
Free information: Circle 50

TEC TecniColor grout:

- **Color consistent; range of colors**
- **Stain resistant**
- **Needs no sealing**

Vinyl flooring

Melodico vinyl flooring has a non-glare, matte finish. With a UV-cured, factory-finished PUR coating, the product never requires waxing, stripping, or buffing. It is rated for heavy-traffic areas and features resistance to high point loading with a ScoF rating of 1,500. The material is also stain resistant. The 2-mm-thick flooring is available in 6-inch by 9-inch and 18-inch-square tiles.

Altro Floors and Walls
Wilmington, MA
Free information: Circle 51

Wall insulation

HunterXci 286 wall insulation for exposed interior wall or ceiling use is a rigid-foam product with a polyiso foam core between glass fiber-reinforced foil facers, one side reflective and the other non-reflective. The product provides a high R-value/inch with a thin profile, easy installation, light weight, and is available in 25 psi. The panels meet NFPA 286 specifications and may be left exposed on interior walls with no additional thermal barrier. Available in 4-foot by 8-foot panels or custom sizes from 1-inch to 3.1-inch thicknesses, the product has R-values from 6.3 to 19.5.

Hunter Panels
Portland, ME
Free information: Circle 52

Flexible walls for education

Smartition rotating wall system provides a range of options for educational spaces. The system has a pre-installed, rated dual conduit for data and electrical connections. Units can be a single, stand-alone rotating door, or be designed side by side to allow separate learning zones within the same space. The rotating door is supported by the company's Unispan overhead-support system, allowing the rotating system to be installed in new or existing classrooms.

Hufcor
Janesville, WI
Free information: Circle 53

Photographic wall covering

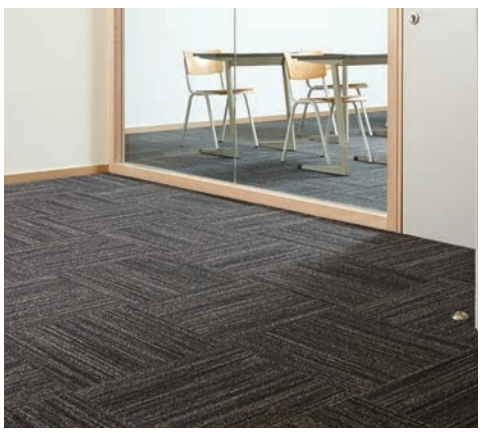
Nimbus wall covering is from a collection based on painting and photography. A nod to the collection's creative concept, Nimbus plays with dark and light. As clouds appear when a storm is about to break, the wall covering uses wide, gestural brush strokes that seem to roll along the canvas like clouds. The product is available in five colors and is 67-inches wide with no vertical repeat.

Trove
New York
Free information: Circle 54

Rubber stair treads

An 8-page brochure describes a line of rubber stair treads, cove risers, and landing tiles. Information is also included on rubber and aluminum treads for exterior applications. All interior rubber treads are available with 2-inch abrasive Grit Strips for additional safety.

Musson Rubber
Akron, OH
Free information: Circle 55



Modular tiles

Trilogy Tile line of modular tiles provides contemporary style with functionality. As modular entrance tiles, the products keep dirt and debris out of a building and also are said to reduce introduction of fine dust particles to indoor air. Fully recyclable, the tiles can contribute to LEED credits. Available in Oyster, Portabello, and Truffles colors, the tiles also offer a designer look. Applications include healthcare settings, multifamily residences, and restaurants.

Mats Inc.
Stoughton, MA
Free information: Circle 56

Perimeter panels

EcoCore phase-change panel is said to reduce indoor-air temperature fluctuations and save energy. During the peak solar load of the day, the phase-change material embedded in the steel panel melts and absorbs energy. The stored energy is held within the panel until cold air allows the material to resolidify and release heat into the space. Material changes from solid to liquid at 75 F, when each panel can absorb more than 175 BTUs.

Tate
Jessup, MD
Free information: Circle 57

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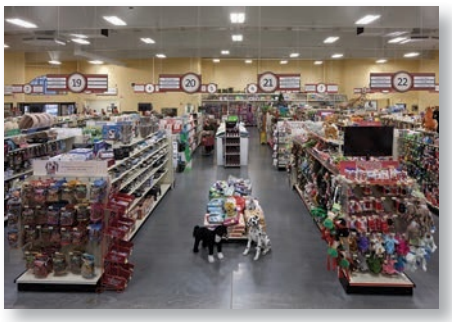

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JAN/FEB 2014

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PLEASE RECYCLE

supplier INDEX

portfolio

The upper portion of the recently renovated B&B Carousell pavilion, which houses the famous Coney Island (NY), carousel, is wrapped in 64 custom perforated panels totaling 3,731 sq. ft. The panels feature painted graphics of horses and double as solar shading and a backdrop for the new "Carousell" sign. The pavilion was designed by the Rockwell Group, New York. The contractor was Themeing Solutions, Henderson, NV. The panels were manufactured by Hendrick Architectural Products Inc., Carbondale, PA.

Big Tubes For Big Spaces

NEW SkyVault M74 DS (29” dia.)

- WAREHOUSES
- MANUFACTURING
- AIRPORT TERMINALS
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- RETAIL SPACES

New Solatube SkyVault M74 DS

The Solatube SkyVault M74 DS is the first phase in a trailblazing new line of daylighting products intended specifically for high bay, high-volume environments. Our largest tubular daylighting device ever, it features a 29 in. (74 cm) diameter tube that is nearly twice the aperture of our SolaMaster Series products. As a result, it maximizes light output and minimizes the number of roof penetrations required.

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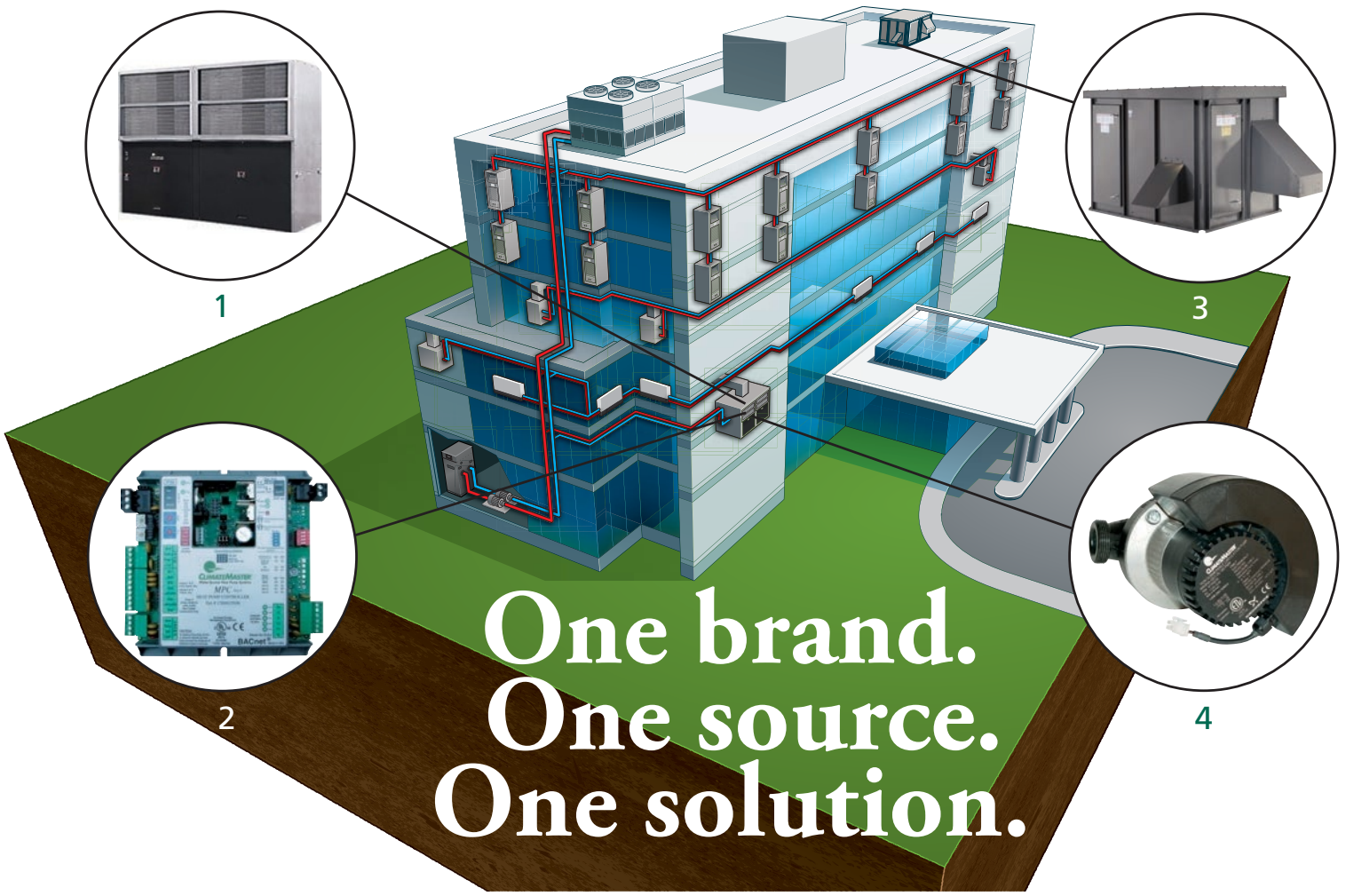

ClimateMaster® delivers complete water-source or geothermal heating and cooling solutions for every segment of the commercial construction market. Because we can provide all the components required for most applications, you are assured a perfectly matched, perfectly controlled, perfectly installed system.

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A ClimateMaster® system will provide both heating and cooling to the building, changing modes based on the building load. Heat can even be transferred from one part of the building to another. A single control system will manage all these functions. You'll need less equipment and have a completely integrated system.

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Factory-mounted Direct Digital Controls lower installation costs by reducing problematic on-site wiring. Implement a variety of building automation protocols through a PC, and read fault codes from any remote location.

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