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The adaptable DC

By Bill Epmeier

As the dynamics of the grocery supply chain have evolved, warehouses and equipment have kept pace.

Nothing has changed more in the supermarket business over the past 15 years than the distribution channel that links manufacturers, warehouses and stores. While advanced logistics management systems tend to get most of the attention, there have also been major changes to the warehouse itself and the equipment within.

One need look no further for change than the loading dock, according to Keith Swiednicki, senior partner at KOM International, Inc., a warehouse design, engineering and consulting company based in Montreal. “The dock is becoming more and more the heartbeat of the facility,” he says.

Traditionally 60 to 65 feet in depth, docks are now being expanded in newly designed centers to depths of as much as 110 feet. No longer are they used simply as unloading points for supplier merchandise going into storage. Today, the emphasis is on inventorying as little as possible in the warehouse. Increasingly, merchandise is coming in from suppliers and distributors already picked and wrapped for individual stores. These items are being received and then held on the docks in staging areas to be married up with picked items from the warehouse and shipped out to the stores within the same day.

The name of the game is inventory turns, Swiednicki says. Just-in-time deliveries mean stores are receiving smaller, more frequent deliveries, sometimes as often as once a day. This change in philosophy has freed up slots inside the warehouse that used to be used for longer-term inventory storage, but it has increased pressure on loading docks because of the more frequent scheduling of both shipments and deliveries.

In perishables warehouses, loading docks are increasingly being refrigerated, notes John McGlasson, vice president for logistics planning at Food Tech Structures in Hanover, Mass. “Ambient is being treated as just another climate,” he says, adding that the cost of refrigerating more docks is more than offset by the growth in productivity that comes with increased flexibility to ship or receive from many different doors.

In refrigerated warehouses, another trend is to break down walls that separate by commodity and instead store products by climate, McGlasson says. For example, produce, wet produce and deli items that in the past would have been stored in separate 34-degree rooms now share a single room.

Changing methods of delivery to stores can cause unexpected problems for warehouse designers. To illustrate, the growing popularity of using large plastic bins for direct delivery of produce to stores is causing headaches for warehouse operators when it comes to fire regulations, notes Ed Hess, associate principal and program manager for the design center at Carter & Burgess, a design and engineering firm for the warehousing industry based in Fort Worth, Texas. Hess says the plastic composition of the bins, which double as fixtures on the produce floor of stores, is forcing warehouses to reclassify their produce rooms under local fire regulations. The reclassifications affect the way in which sprinkler systems are sized and rated within the rooms.

ENERGY CONSERVATION

Because warehouses are major energy users, designers are looking at a variety of ways to conserve energy, Hess says.

Nowhere is the payoff bigger than in lighting. Old HID lamps, which burn hot, are being replaced by extremely efficient T5 compact fluorescents in six-lamp fixtures, which have become the standard for the industry. According to McGlasson of Food Tech, investing in T5s can pay for itself within a year when utility subsidies are taken into account.

Maintaining a tight building envelope is critical to energy saving, says Jim Short, project manager for Carter & Burgess's food and beverage division. Again, loading docks are a major focus for this effort because doors are the major source of air infiltration from outside.

Air curtains, for example, have traditionally been vertical flows, with air blowing from the top of the dock downward to keep outside air from coming in. Recent tests have shown that horizontal blowers are more efficient in preventing infiltration, so Carter & Burgess has been specifying these in its projects.

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IMPROVING THE SEAL

Better seals around trucks when they are backed up to the dock have also been developed, along with higher insulation values on doors. One of the simplest and most effective dock seals is an inflatable unit that has a small motor that pumps up a canvas-type pillow around the truck opening. Short adds, however, that no matter how good the seals and R-factor on the docks, energy conservation efforts will fail without building pressurization. Pressurization refers to keeping the level of air pressure higher inside the building than out, so that when there is an opening, air flows out of the building rather than in. Pressurization zones within the warehouse need to be carefully designed, and the air-handling systems properly sized to maintain differing zones.

Ammonia refrigeration systems are replacing those cooled by Freon because ammonia is cheap and does not contribute to global warming. Another advantage of ammonia systems is that piping can be run on the exterior of the building so it is not susceptible to damage by fork lifts. Even though ammonia systems cost more to build than Freon-based systems and require extensive safety training and documentation for larger systems, they are reported to pay for themselves within a short time because their operating costs are so much lower.

Cooling capacity in the warehouse is also being used to drive chilled water and glycol heat exchange systems that air-condition and dehumidify offices and other ambient areas in the warehouse. In these systems, ammonia does not circulate within the office, but instead cools a secondary system that uses chilled water or glycol.

The energy-saving potential of heat is not being overlooked, either. Heat is being recovered from cooling towers on the roofs of warehouses and piped under the floors of refrigerated warehouses to keep the ground under the foundation from freezing. Heating the sub-grade is necessary because over time the earth under a freezer will freeze and heave, causing the foundation to crack.

Another equipment improvement is the move to use variable frequency drive (VFD) systems on refrigeration and air-handling equipment. Traditionally, blowers and compressors are either on or off, but with VFD the equipment cycles on at varying speeds, which not only saves energy but also improves the working environment for employees who do not have to endure the “wind chill” effect that comes when fans in coolers and freezers cycle on at full strength.

Supermarket warehouse operators are investing in a variety of other sustainable, environmentally friendly features. In some instances local building codes are forcing the issue, but even more important are the operating efficiencies.

Examples of green improvements to warehouses include:

-Solar electric systems on the roof. Tesco, the U.K.-based retailer that is moving into the United States, has reportedly installed a $10 million solar system to run electrical systems in one of its new warehouses.

-Skylights. Hess of Carter & Burgess says his company has been installing skylights in many of its recent projects as an energy-saving feature. Especially efficient, he says, is a day lighting system from Solatube of Vista, Calif. The drawback to skylights in the past have been their propensity to leak, but manufacturers have come up with better detailing to prevent this problem.
uRetention ponds to capture storm water runoff from roofs and parking lots.

-More use of recycled materials, such as concrete, steel, interior finishes and carpeting.

-Designers are also looking beyond the warehouse to the trailer staging areas where trucks can idle for hours before unloading. Pollution from idling engines is a problem that local governments are beginning to target. Increasingly, standby electricity to run truck refrigeration units is being provided to staging areas and loading docks. At some centers, air conditioning for the truck cab is being delivered through tubes that are pulled in through the cab windows.

Swiednicki says a lot of the warehouse work that KOM is called in on involves standing structures rather than new construction. “In most cases operators are looking for better utilization of existing assets,” he explains. ‘We shoot for getting 15% to 20% improvement in productivity on our projects. Productivity improvement is what drives design changes.”

UNINTENDED CONSEQUENCES
One of the dangers in analyzing a warehouse’s productivity is to focus too narrowly on a particular function, Swiednicki says. For example, it is possible to shorten the picking line and thereby make the picking operation more productive, but this design improvement is more than offset by the need to replenish the picking areas more frequently. More frequent replenishment involves more work for forklift operators, who are the most expensive component of warehouse labor. An unintended result can be that improvements in productivity in one function are more than offset by inefficiencies in another.

Automated storage and retrieval systems (ASRS) make sense in high-volume operations. These systems are often sold on their labor-saving potential, but Hess says that, at least in perishables warehousing, one of their primary advantages is that they help to retain employees. Work in refrigerated rooms and freezers is difficult and worker turnover is high. ASRS systems help by limiting the number of employees and the time that they must spend in refrigerated areas.

One warehouse operating improvement of recent years has been the move to install battery charging stations. Instead of having to idle a forklift in order to recharge its battery, an operator can now quickly change batteries and drive off with a newly charged one, thus eliminating downtime.

RISING RACKS

Rack heights are going up, and more varied racking is being designed into warehouses. In the past most racks topped out at 32 feet, but in newer warehouses racking is up to 38 feet in height. Such high density allows operators to pack in more inventory without expanding the warehouse footprint. The attraction is economic: The cost of going up is only a fraction of the cost of going out, explains McGlasson of Food Tech.

One type of racking that is disappearing from most food warehouses is the “double-deep” racks that accommodate two pallets, front to back. They were used extensively when warehouses stocked many forward buys on promotional merchandise and held it in inventory for months at a time. Today, the emphasis is on turns, Swiednicki of KOM says, and most racks are just one pallet deep.

Facilitating the move to higher racks is the development of new sprinkler systems that can be installed on roofs up to 42 feet high. These early suppression fast response, or ESFR systems are an improvement over in-rack sprinklers, which had been the only option available to designers who wanted roofs higher than 32 feet. The problem with in-rack sprinklers is that they are susceptible to damage during picking operations, explains Randy Broome, senior project manager for the Facilities Group, an Atlanta-based engineering firm that designs and builds distribution centers.

Materials handling equipment has become heavier and more elaborate, a development that has put stress on warehouse flooring. This is particularly a problem in high-traffic areas like loading docks, where forklifts are especially hard on joints between concrete slabs. There are solutions like armored joints and improved concretes made with fiber-reinforced and shrinkage-compensating mixes, but often the decision comes down to money. Warehouse owners are reluctant to invest in higher upfront costs if it is not completely apparent that they can recoup the investment down the road.