WHITE PAPERS

Best Practices in Distribution and Cold Storage Facilities

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Taking Solutions Further:

The design and construction of a distribution warehouse is more complex than meets the eye. In this white paper, we discuss the benefits of an integrated, team approach to designing a cold storage facility and address important budget considerations. We also highlight the advantages of two best-in-class features for warehouses, the Quell™ fire protection system and shrinkage-compensating flooring.

Why an Integrated Approach is Crucial in Designing and Building Distribution Facilities

Industrial designers, architects, mechanical engineers, refrigeration experts and a thermal team all working together can lead to a more functional, efficient, and cost-effective facility. Working with multiple contractors in multiple locations increases the likelihood of miscommunication, competing workflows, and increased costs — in addition to a longer production schedule.

The benefits of employing a team approach to building a distribution facility include:

1. **More informed decisions through building information modeling (BIM)** — BIM allows all team members to see a three-dimensional view of the facility and many owners find it beneficial for the team to take a virtual walk-through together to address workflows. For example, refrigeration and mechanical engineers can review the layout with owners to ensure an efficient path for maintenance personnel to access equipment, or review piping arrangements to ensure they are fully coordinated with the building structure.

2. **Industrial designers and product experts** — Hiring a team with experience in the distribution industry can improve the facility's overall function and workflows, in that there is required logic and intelligence behind the facility layout, product location, racking type, material handling devices, and picking methodology. Designers can work directly with internal distribution industry experts to optimize and analyze the product demand and picking process, placing faster moving products near the dock doors and slower movers in the back of the facility.

3. **Refrigeration requirements** — Because proper refrigeration is crucial to food safety in distribution warehouses, it's critical that the refrigeration team and thermal experts collaborate with designers. With multiple temperature requirements within a single warehouse, refrigeration and thermal experts will often dictate which rooms need to be adjacent based on similar temperatures or future planned uses of a room. Thermal experts must also have input on the installation and thickness of the insulated metal panels between rooms, underfloor insulation, underfloor heat, and other related factors.

4. **Projecting future temperature needs** — As market demands change, so do the refrigeration needs for distributors. Refrigeration team members can often make recommendations to the designers on how to incorporate flexibility into cold storage areas. For example, a cooler can easily be converted to a freezer at a later date if properly designed initially. This provides more flexibility during future expansions to accommodate either cooler- or freezer-based products.

5. **Location of mechanical room** — With varying temperature requirements within the facility, electrical, mechanical and refrigeration engineers should work closely to determine the most efficient location of the utilities and mechanical rooms to ensure the most cost-effective solution, reliability, and energy efficiency.

6. **Building envelope** — The thermal team should be involved in every step of the process to determine the appropriate building materials. Roofing, insulated metal panels, and flooring will all be driven by the decisions made by other teams, with the potential to impact profitability and food safety.

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Ensure Your Cold Storage Facility Has a Best-in-class Fire Protection System

Today, many food distribution warehouse owners are turning to a new fire protection system designed specifically for cold storage facilities. The Quell™ Fire Sprinkler System, developed in 2006, is an advanced system that uses a "surround and drown" approach to rapidly control a fire using a large volume of water. This not only puts out the fire quickly, but also reduces heat and minimizes damage to the distribution facility itself and to the contents and products.

When a sprinkler is activated, water is discharged on a delay to allow time for one or more other sprinklers to be thermally activated by the fire, ensuring sufficient water volume and cooling is applied to control it before it can spread. Developed by Tyco Fire & Building Products, this system should only be installed by licensed contractors.

The Quell Fire Sprinkler System offers many benefits for distribution warehouses including:

1. **Dry pipe system** — As a dry pipe sprinkler system, it does not require antifreeze, which is required in most wet pipe sprinkler systems to avoid freezing. Wet pipe sprinkler systems using antifreeze have been under review, with a concern about the combustibility of high concentrations of antifreeze. Additional precautions and some regulations must also be taken in regard to backflow contamination of potable public water supplies when using antifreeze systems.

2. **Class range protections** — The Quell system provides fire protection for Class I, II, III and Group A plastic commodities. This means frozen foods, foods in plastic or even combustible containers are protected, including certain alcoholic beverages and wide range of other goods various containers.

3. **Less expensive to install, operate and maintain** — Pipes are located in the ceiling only, so they're less expensive to install than costly in-rack installation. In addition, the sprinklers are easier and more cost-effective to maintain through ceiling access.

4. **Flexible storage** — Since the sprinklers are located in the ceiling, roof and storage heights can be higher, allowing the facility to utilize more flexible stocking configurations.

5. **10-year warranty** — The Quell Fire Sprinkler System is backed by the industry's best 10-year limited warranty.

Four Reasons Shrinkage-Compensating Floors Make Sense for Warehouses

The floors of food distribution facilities must endure a lot wear and tear, with heavy forklift traffic continually moving across the surface. As new warehouse facilities are being built, owners are choosing to invest in shrinkage-compensating concrete for the flooring, which eliminates control joints, reduces curling, and minimizes cracks.

Most flooring damage starts at the joints. With conventional concrete floors, joints are spaced every 10 to 20 feet to eliminate cracks from running the length of the floor. These joints are often filled with a semi-rigid epoxy, which presents inherent maintenance requirements. Made with an expansive cement, shrinkage-compensating concrete has 90 percent fewer joints than conventional floors.

The four main benefits of shrinkage-compensating concrete floors include:

1. **Equipment protection** — Forklifts can tear up a concrete floor, but they can also incur damage after repeatedly going over curled joints, spalled joints, and large cracks in the floor. Expansive concrete can actually reduce maintenance and extend the life of equipment, thus reducing operating costs.

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2. **Higher compressive strength** — Shrinkage-compensating concrete inherently has a higher compressive strength, making it a much more durable option for large distribution facilities with heavy forklift traffic.

3. **Reduced maintenance** — The amount of joints are greatly reduced, requiring less maintenance on the floor. Reduced permeability, lack of curling, and increased resistance to sulfates also add to the durability of shrinkage-compensating concrete.

4. **Employee safety** — By eliminating cracks and joints, injuries to employees who drive forklifts (which often have no shock absorbers) are reduced. Improved safety has an impact on everything from productivity to workers' compensation claims and premiums.

Five Budget Factors to Consider When Designing Cold Storage Warehouses

From the outside, cold storage facilities can appear to be large, simple boxes. However that perception is far from reality—they actually require an advanced, detailed analysis in the design phase to achieve significant operational cost savings.

At its core, a cold storage facility is designed around the type of product to be stored and how long it will sit on the shelves. But as technologies and techniques aimed at improving efficiencies have proliferated, cold storage warehouses have become more complex to design. Here are five key budget considerations to keep in mind:

1. **Energy Efficiency** — Energy costs to operate cold storage facilities can reach tens of thousands of dollars each month. Factors that can influence and improve the energy efficiency of the facility include underfloor heating systems, consideration of adjacent room temperatures, and LED lighting. The orientation of a building can also improve energy efficiency with higher temperature rooms located at the southern end of the facility, and lower-temperature rooms at the northern end.

2. **Refrigeration** — Factors that influence the efficiency of a refrigeration system include compressor, condenser, evaporator and air unit selection, variable frequency drives, and premium-efficiency motors. These factors must be carefully balanced with operational demands and return-on-investment criteria.

3. **Refrigeration Controls** — In addition to mechanical efficiencies, automation can greatly improve refrigeration efficiency and optimize energy use. Automation allows engineers to generate trend analyses, alarm logs, energy management data, and runtime reports in real-time. This data allows them to make the necessary changes and modifications to ensure the refrigeration system is running at optimal efficiency.

4. **Thermal and Roofing** — With the staggering energy demands of cold storage facilities, it's vital to construct a vapor barrier of uncompromising integrity. Numerous thermal details must be considered including insulation thickness for the floors, walls and roof, low-temperature door systems, and the use of insulated metal panels for adequate vapor seals. Roofing coated with a reflective white membrane can also reflect the sun's rays for added energy efficiency.

5. **Electrical Utilities** — Loss of power in a cold-storage facility can lead to significant financial losses. Design considerations for electrical utilities should include operating voltages, reliability and redundancy of supply, standby generation and machine and electrical room locations that provide optimal utility distribution.

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