

design plans & ideas

Planning Guidelines for Manufacturing, Warehousing, and Distribution

MARCH 2001



What's inside

IN TODAY'S COMPETITIVE E-COMMERCE ENVIRONMENT, economics and efficiency are the names of the game. To be successful, companies need to design the right facility layout and select the proper mix of materials handling equipment and systems to streamline the handling of orders and speed products to the end customer. In this special E-Commerce edition of Design Plans & Ideas, we show you five different facility layouts – each highlighting a different function or area – that are world-class in their overall approach to materials handling.



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Looking ahead: In July, we take a look at the world of third party logistics (3PL) through the eyes of DPI.



Achieving **WORLD CLASS** E-Commerce

Flexible materials handling equipment and systems is the name of the game for top E-Commerce companies

"The one thing that people don't realize about E-Commerce is that it's all about real-time demand," says Chris Sang, Founder, Chairman, and CEO of iFulfillment, Inc.

A distribution veteran who cut his teeth in the specialty retail business, Sang for the past several years has worked exclusively in Internet-based distribution. His most recent venture, iFulfillment, is a third party logistics provider who counts among its cus-

tomers Nordstrom.com and GoldenBooks.

Given the fact that no two orders are alike and the number and type of stock keeping units (SKUs) in an E-Commerce environment are constantly changing, Sang says that there is little opportunity to take advantage of the strategies traditional DCs employ to achieve order handling efficiencies and economies of scale.

"Traditional DCs have a way of dealing with dimensional variability by consolidating orders

into case or pallet quantities," explains Sang. "In E-Commerce that's not possible."

Flexibility is key

So how do top DCs cope with lack of standardization? Sang says that companies need to ensure that they build sufficient flexibility into their handling equipment and processes to handle a broad cross section of SKUs and orders. "Otherwise, you're going to wind up with a tremendous amount of work-arounds, which are going to kill you from a cost perspective," says Sang.

As an example, Sang describes the pitfalls associated with standardizing on an equipment solution designed to exclusively handle a conveyable product. "At some point down the road, the business is likely to shift and suddenly the DC is handling items that can't ride on conveyors," says Sang. "Those items will all have to be handled on an exception basis, which costs time and money."

Bottom line, says John Yacka, a systems designer with the consulting company Gross & Associates, is that the E-Commerce environment really



E-Commerce DCs may not look any different on the outside from a traditional DC, but management must implement special strategies and processes to handle such unique requirements as real-time demand, gift wrapping, and returns.

"From an equipment perspective, you're not going to see a whole lot that is different in a world-class E-Commerce facility," John Yacka, Gross and Associates

mandates different processes for different types of business. "It's not uncommon to see several different types of order processing strategies within a single facility," says Yacka.

As an illustration, Yacka points to the E-Commerce DC for handling books and entertainment items featured on page d16. The fastest-moving items to fulfill consumer orders are picked from multiple lanes of pick-to-light rack. Retail orders are batch-picked in a special put-to-light system, where items are picked into storage locations rather than from them. Slower-moving items, which account for a small percentage of the activity but consist of over 95% of the total SKU mix, are picked from economical storage shelving.

"By setting up DC operations in this way," says Yacka, "Warehouse management is ensuring that each order is handled in the quickest, most economical manner." Yacka adds that it's a concept that top traditional DCs pioneered, and that E-Commerce DCs have been quick to embrace.

For the most part, these flexi-

ble picking areas are comprised of proven, effective materials handling equipment and systems, including flow rack, storage shelving, pallet rack, take-away conveyor, and returnable totes and containers. A combination of industrial trucks, including counterbalanced lift trucks and pallet jacks, help to streamline the flow of orders (see layout, pg d12).

"From an equipment perspective, you're not going to see a whole lot that is different in a world-class E-Commerce facility versus a world-class traditional DC," says Yacka. "They are all applying basic, proven materials handling equipment and systems to their particular business environments."

A WMS system is an effective tool for helping E-Commerce management optimize picking operations, by monitoring operations and reassigning work flow on the fly. It's also helpful in monitoring the SKU mix and activity levels, reassigning storage locations to improve picking throughput and maximize use of the cube. And software can help manage the complexities of E-

Commerce distribution (see layout pg d16).

Software also plays a critical role in helping E-Commerce facilities manage special services such as gift wrapping and order expediting, as well as returns. "Management needs to be able to discern different product and order profiles, and make decisions on the fly on whether they will be handled differently," says Sang. "For example, you may want the capability of kitting orders in advance that require gift wrapping."

This kind of flexibility even extends to the dock area, as shown in the DC for health and beauty aids on pg d10, where dock levelers can aid E-Commerce DCs that are often confronted by an array of delivery vehicles. Even at facilities where the traffic is standardized on a particular trailer type, installing a dock leveler at one door builds in the flexibility to accommodate the occasional non-standard vehicle.

In the end, being a top E-Commerce DC is a little bit like stealing second while keeping your feet just partway on first. "Unfortunately, companies are having to plan their DCs without really knowing what their requirements will be in two to three years," says Sang. "The important thing is to remain flexible, and learn to manage with shorter planning horizons."

FIVE KEYS TO E-COMMERCE SUCCESS

- Build flexibility into your operation to handle variability in orders and SKU mix
- Exploit proven materials handling equipment and systems
- Keep in mind that a WMS system is an effective tool for optimizing picking throughput, managing inventory, and streamlining operations
- Recognize that unlike a traditional DC environment, E-Commerce is all about real-time demand
- Plan for the unexpected, the SKU and order mix tend to be more volatile in an E-Commerce environment

GROSS
& ASSOCIATES

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The FreeWheeler' incorporates the latest technology in thermo plastic engineered resin, and structured wheel design.

The material used to make the FreeWheeler' wheel is composed of crystalline-based resin, which provides significant strength to the unit. It is combined with several lubricating ingredients, which enhance the strength and

provide lifetime lubricity to the surface of the inner race. The wheel's design is a 1.9" diameter by 1.125" rib reinforced with an axel of 5/16". The steel axel is a proprietary designed unit that is infused with a high temp coating which enhances flowability and lubricity of the FreeWheeler' wheel. The capacity of the wheel far outdistances the currently available competitors' units. The wheel, based on optional axels, ranges from 150 lbs. — our light-duty wheel — to 250 lbs. — our heavy-duty wheel. The FreeWheeler' system can be used in carton flow, pick modules and wash-down applications.



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(PATENT PENDING)

Contact us at 1-770-514-0711 or visit us on the Web at www.creativestorage.com

Circle 700

Housewares DC

Proven picking methods and equipment team up for high-throughput handling at this medium-volume facility

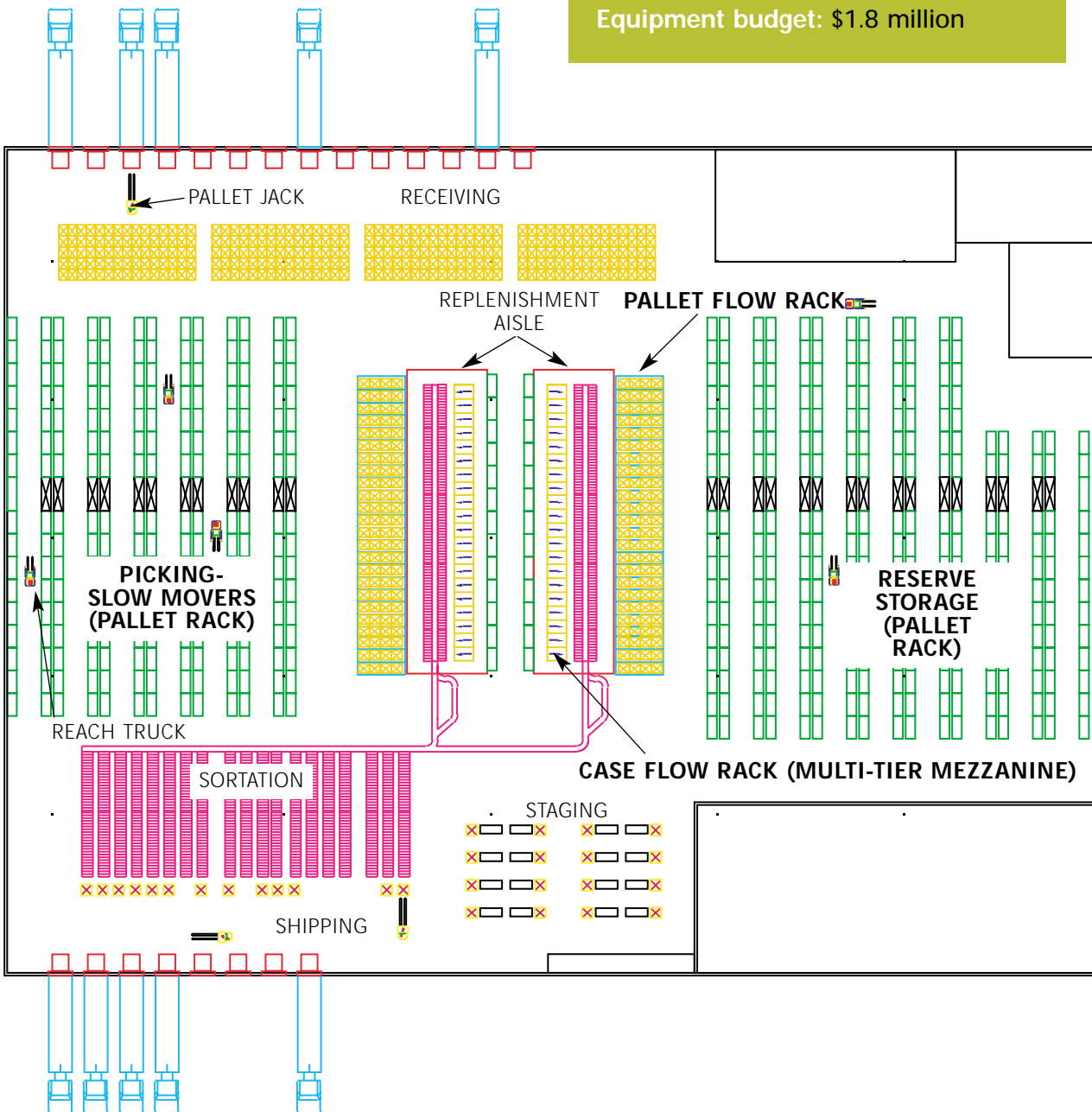
Quick handling of orders is top priority at this facility, whose E-Commerce customers want immediate delivery of products. To maximize picking throughput and efficiency, stock items are located by activity level and type (ie full case, broken case) in this DC for housewares. Full pallet loads are received in, with the fastest-moving items going directly into pallet flow rack for case picking or a replenishment aisle for case flow rack. High-

volume, piece-to-belt picking is done from case flow rack and case-to-belt from pallet rack on a two-level mezzanine. Reserve storage and medium and low-volume case picking using reach trucks is done from selective pallet rack on either side of the picking mezzanine. An in-aisle takeaway conveyor transports picked items to a sortation system at the dock, where items are sorted and palletized by order, then staged for loading onto trucks for customer delivery.

- Multi-tier mezzanine picking frees up floor space for additional staging and storage—levels can be added as required
- Carton and pallet flow rack provides the maximum number of pick faces over the smallest distance, leading to highly efficient picking operations
- To optimize picking throughput, items can be zoned within carton flow rack (the fastest moving items stored in the most accessible picking locations)
- Assignment of random storage locations within zones optimizes efficiency
- Light displays can be added to picking locations to boost productivity further
- Takeaway conveyor shortens pick path and minimizes handling
- Selective pallet rack located in picking mezzanine facilitates quick replenishment of case picking operation and FIFO rotation of inventory
- Locating picking mezzanine in center of facility minimizes travel distances for replenishment operations
- Arrangement of picking operations allows very slowest-movers to be picked off-line, maintaining high throughput overall

FACILITIES OVERVIEW

Total Warehouse space: 120,000 sq ft
 Clear height: 24 ft
 Number of SKUs: 5,000
 Throughput: Medium volume
 Number of employees: 65
 Equipment budget: \$1.8 million





SERCO

A United Dominion Company

SERCO & SUBMITORDER.COM

TEAM UP FOR SUCCESS

E-COMMERCE IS WITHOUT A DOUBT ONE OF the fastest growing industries. Some of the larger e-retail companies process an estimated 60,000 transactions daily, and that number is expected to increase rapidly over the next two years. To keep up with that growth, many companies selling products on-line are outsourcing e-fulfillment, especially distribution, with minimal capital investment, while maintaining speedy delivery to their customers.

Recognizing this trend, SubmitOrder.com based in Ohio opened its doors in 1999 to provide e-fulfillment support to Internet merchandisers. As the industry's leading provider of Internet e-fulfillment services to e-commerce companies, SubmitOrder.com operates three distribution centers throughout Ohio, in addition to providing services such as strategic development, database development and supply chain consulting. In response to its rapid growth, the company planned for a new 600,000 square-foot DC in Memphis, TN.



The facility utilizes 61 dock positions with just-in-time operations, distributing a vast array of products and retail merchandise. In many cases, as soon as product arrives on the dock,

SubmitOrder.com must ship it out to the customer. With this type of operation, they were looking to outfit the dock with easy-to-use levelers, but also wanted vehicle restraints for added safety.

SubmitOrder.com installed 61 Serco SL 2060 automatic vehicle restraints. Dual locking positions on the SL series restraints restrict trailer movement, the leading cause of forklift accidents. The simple push-button controls and the advanced inside/outside communication system provide greater dock safety and eliminate confusion for dock attendants and drivers alike.

Contact us at 1-972-466-0707 or visit us on the Web at www.sercocompany.com

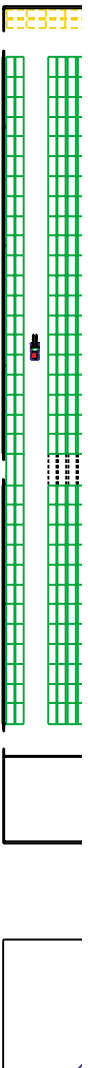
Circle 701

Health and beauty aids DC

Customer service is paramount at this facility, which serves E-Commerce customers. Merchandise arrives in pallet loads at this high-volume facility in a wide variety of vehicles, from vans to trucks, requiring flexible dock operations. Approximately 15% of the incoming product at this facility is taken directly from receiving to the shipping dock, in a practice known as cross docking. Fastest-moving items are taken directly from the receiv-

ing dock via conveyor to the replenishment area (pallet racks) for the broken-case pick module. Located at right angles to the pick line, the replenishment area can be served by industrial trucks. Full cases are picked on a high-speed slapper line. Reserve storage is housed in double-deep racks, served by reach trucks. Picked items travel by overhead conveyor to the shipping dock, where they are sorted by order and loaded onto trucks for delivery.

- Ample space built into both shipping and receiving areas for pallet staging facilitates cross-docking operations and minimizes congestion
- Unique L-shaped dock area (result of existing building design) minimizes travel distances for cross-docking operation
- Overhead conveyor at shipping dock increases accumulation capacity and frees up floor space for staging of cross-docked pallets
- Extendible conveyors used for direct truck loading boost productivity and take up space only when in use
- Hydraulic dock levelers at the receiving dock feature a loading platform, standard dock leveler, and adjustable bumpers to accommodate a wide range of delivery vehicles
- Although shipping operations are standardized for a particular trailer type, a hydraulic dock leveler is installed on one dock door to accommodate the occasional non-standard vehicle
- Vehicle restraint systems on both the shipping and receiving docks secure the rear wheel of a truck or trailer to ensure safe dock operations
- Dock shelters and seals help the dock area stay cleaner by sealing out dirt, debris, and dampness



design plans & ideas

Flexible dock equipment and facility layout of the dock area support cross-docking and rapid handling at this high-throughput DC

FACILITIES OVERVIEW

Total Warehouse space: 157,000 sq ft

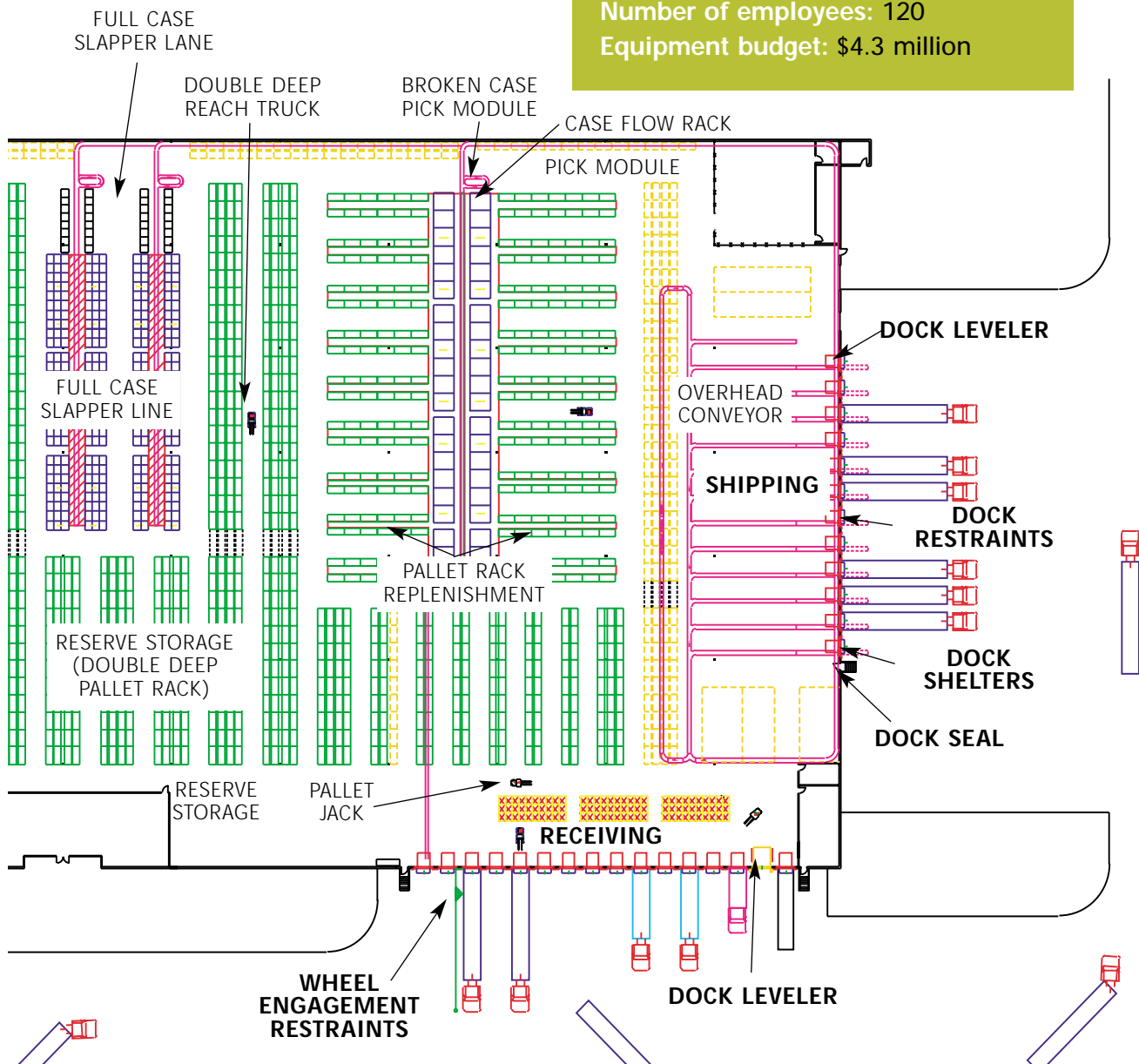
Clear height: 30 ft

Number of SKUs: 30,000

Throughput: High volume

Number of employees: 120

Equipment budget: \$4.3 million



dock equipment



NISSAN FORKLIFT CORPORATION, NORTH AMERICA – A PROFILE

THE NISSAN INDUSTRIAL EQUIPMENT DIVISION of Nissan Motor Company Limited began manufacturing forklifts in Japan in 1957, and has been selling forklifts in the United States since 1965. In 1988, Nissan Industrial Equipment purchased Barrett Industrial Trucks, a manufacturer of industrial equipment in the Chicago, Illinois area since 1914. This purchase made Nissan the first Japanese company in North America to manufacture and distribute all five classes of industrial trucks. The first Nissan forklifts were assembled in Marengo, Illinois in May of 1988. From that small beginning thirteen years ago, Nissan has



seen sales and production grow to over 15 times that first year's production number. In 1993, the consolidation of operations was completed in Marengo and a new

corporation was formed, Nissan Forklift Corporation, North America, manufacturing the Nissan Forklift and Barrett Industrial Truck brands for distribution to the North American market, and export to other global markets.

Nissan Forklift Corporation employs 530 full time employees in their 400,000 sq. ft. facility. The Nissan facility in Marengo is the largest of three Nissan forklift production facilities in the world. Nissan's forklift operations have consistently posted operating profit for the company. Its Industrial Machinery Division employs 1,730 people in Japan, Europe, and the United States, and approximately 30,000 units were sold last year in more than 60 countries worldwide.

Nissan Forklift Corporation, North America is a full line supplier of engine powered forklifts, electric sit-down and stand-up riders, narrow aisle reach trucks, electric pallet trucks, electric tow tractors, electric walkie stackers, and manual pallet trucks in the Nissan and Barrett Industrial Truck brands. Both products are sold and serviced through a North American dealer network with more than 140 locations.

Contact us at 1-815-568-0061 or visit us on the Web at www.nissanforklift.com
Circle 703

Lighting fixtures

Quick order turnaround time is important at this facility, which ships lighting fixtures to E-Commerce customers. To maximize picking throughput and storage efficiency, stock items are located by activity level and unit picked (pallet, case) in this DC for lighting fixtures. Fast-moving SKUs that ship in full pallet quantities travel directly to a block stacking area adjacent to the receiving dock, where product is staged 3 pallets high. Fast-moving SKUs that ship in full case

quantities are staged in 4-level-high pallet rack. Items are all picked to order. Picking takes place at the floor-level pallet position, using a combination of counterbalanced lift trucks and double-length pallet jacks. Replenishment stock is stored in the pallet positions overhead. Slow-to-medium movers are staged and picked in narrow aisle (6 ft wide) pallet rack, 7 levels high, using orderpicker trucks. Completed orders are staged at the dock, which is serviced by pallet jacks.

- Locating block stacking areas adjacent to receiving and shipping streamlines handling of SKUs that ship in full pallet loads (about 20% of volume)
- To minimize congestion, picking lanes for the fastest-moving SKUs are spread over a large area
- Combining active picking and reserve storage in 4-level-high pallet racks is an efficient strategy when the number of SKUs is relatively low, as is the case here
- Use of narrow-aisle (6 ft) pallet racks and orderpicker trucks reduces floor space requirements, takes advantage of overhead space, and leaves room for expansion
- Orderpicker trucks feature many operator comforts, including fingertip control levers, electronic power steering control knob, and an operator-adjustable ergonomic control pod
- Truck-mounted RF terminals facilitate directed put-away, picking, and replenishment for higher picking productivity
- Use of double-length pallet jacks boosts picking productivity, as workers need visit a picking location only once to fill two orders simultaneously
- Highly maneuverable powered pallet trucks make for efficient truck loading/unloading operations

EXPAN
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design plans & ideas

The right mix of picking systems and industrial trucks supports a high-volume DC with a relatively few number of SKUs

FACILITIES OVERVIEW

Total Warehouse space: 90,000 sq ft

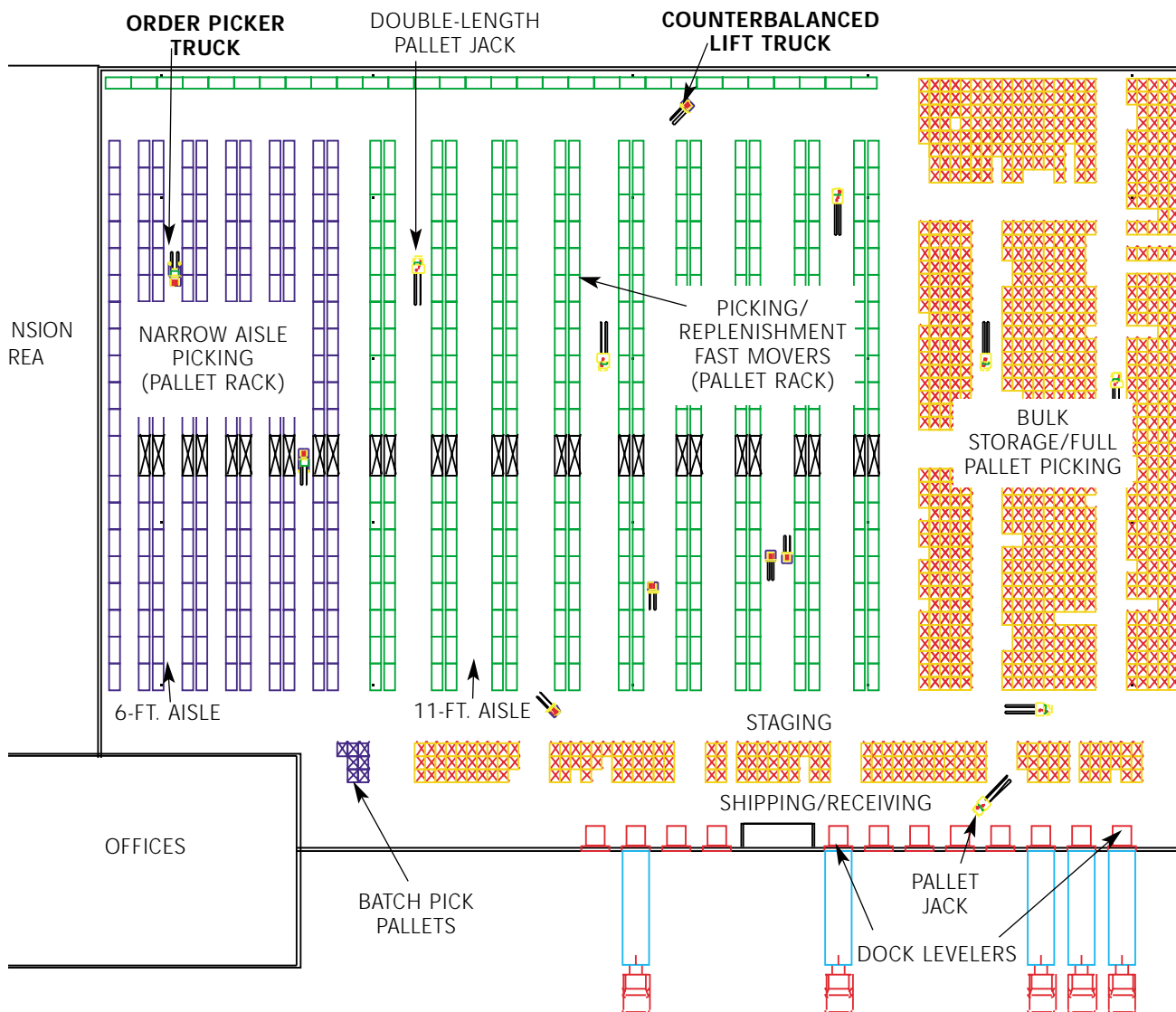
Clear height: 24 ft

Number of SKUs: 600

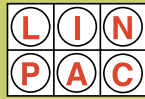
Throughput: High volume

Number of employees: 58

Equipment budget: \$1.1 million



industrial trucks



LINPAC Materials Handling

NEW AND IMPROVED ROPAK™ 4048ns

OFFERS MORE HEIGHT OPTIONS

THE NEW ROPAK™ 4048ns REUSABLE, collapsible container from LINPAC Materials Handling now offers more height options and greater material handling efficiency, convenience and cost savings. Made of tough, durable high-density polyethylene (HDPE), the 4048ns has a 40" x 48" footprint and is available in seven heights: 25", 29", 34", 39", 42", 47", and 50".

The 4048ns now features non-sequential folding sidewalls for easier use and drop doors with articulating hinges, allowing the open door to lay flat against the side of the container. This provides tighter, safer stage and increased application versatility. Doors that open on opposing or adjacent sides of the container can be specified.

The 4048ns containers can be stacked up to 6-high (previously 4-high), conserving more floor space, and are compatible with the original 4048 containers.



The containers have load capacities up to 2,000 lbs., and collapse to a fraction of their height for compact storage and shipping. A dunnage container model is also available.

Other design enhancements include more labeling and product identification options, solid base, and a replaceable fork strap. Custom colors, ventilated base, lids, ID plates and other options and accessories are also available.

The reusable containers manufactured by LINPAC are used to replace single trip paper, cardboard and metal packaging. The ROPAK product line includes pallets, hopper bottom containers and collapsible and non-collapsible container models with footprints ranging from 32" x 30" to 70" x 48", and heights to 50". A full range of design, implementation, financial and support services are available.

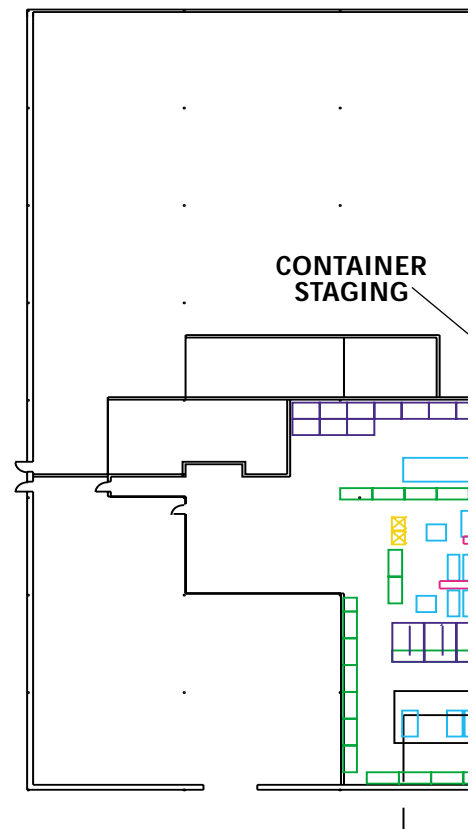
Contact us at 1-800-442-4892 or visit our Web site at www.LinpacMH.com.

Circle 704

Speaker assembly

Returnable containers facilitate JIT parts handling and delivery, streamline order flow in speaker assembly operation

- Combined shipping/receiving docks facilitate U-shaped flow of parts and orders, streamlining handling and reducing travel distances
- Standardizing on one container size keeps container inventory to an absolute minimum
- Containers fold flat when empty, reducing the amount of storage space required
- Space is built in to and around the shipping/receiving dock for staging of both full and empty containers
- Locating of the fastest-moving SKUs near the assembly line reduces travel distance and eliminates the potential for a line shutdown while awaiting a parts delivery
- Inventory turns quickly and the number of trading partners is few, helping the facility maximize the benefits of returnable containers
- Returnable containers present a neat appearance on the assembly line and eliminate packaging waste



design plans & ideas

Time is of the essence at this manufacturing facility, which ships speakers B2B. Parts and components are delivered to the speaker assembly lines on a JIT basis, keeping inventory to a minimum and reducing congestion on the line. Returnable containers, all with a standard 40 by 48 inch dimension, contain lot-size quantities of parts and components. Full containers are staged in a bulk stacking area directly adjacent to the

receiving dock. The fastest-moving items are staged at the ends of aisles in the raw materials storage area, directly adjacent to the assembly lines. Replenishment on the assembly line takes place (via pallet jack) when inventory falls below a certain predetermined quantity. Empty containers, which fold flat for storage and

shipping, are staged near the shipping dock so that they can be returned to vendors on the next pickup of full containers.

FACILITIES OVERVIEW

Total Warehouse space:

78,000 sq ft

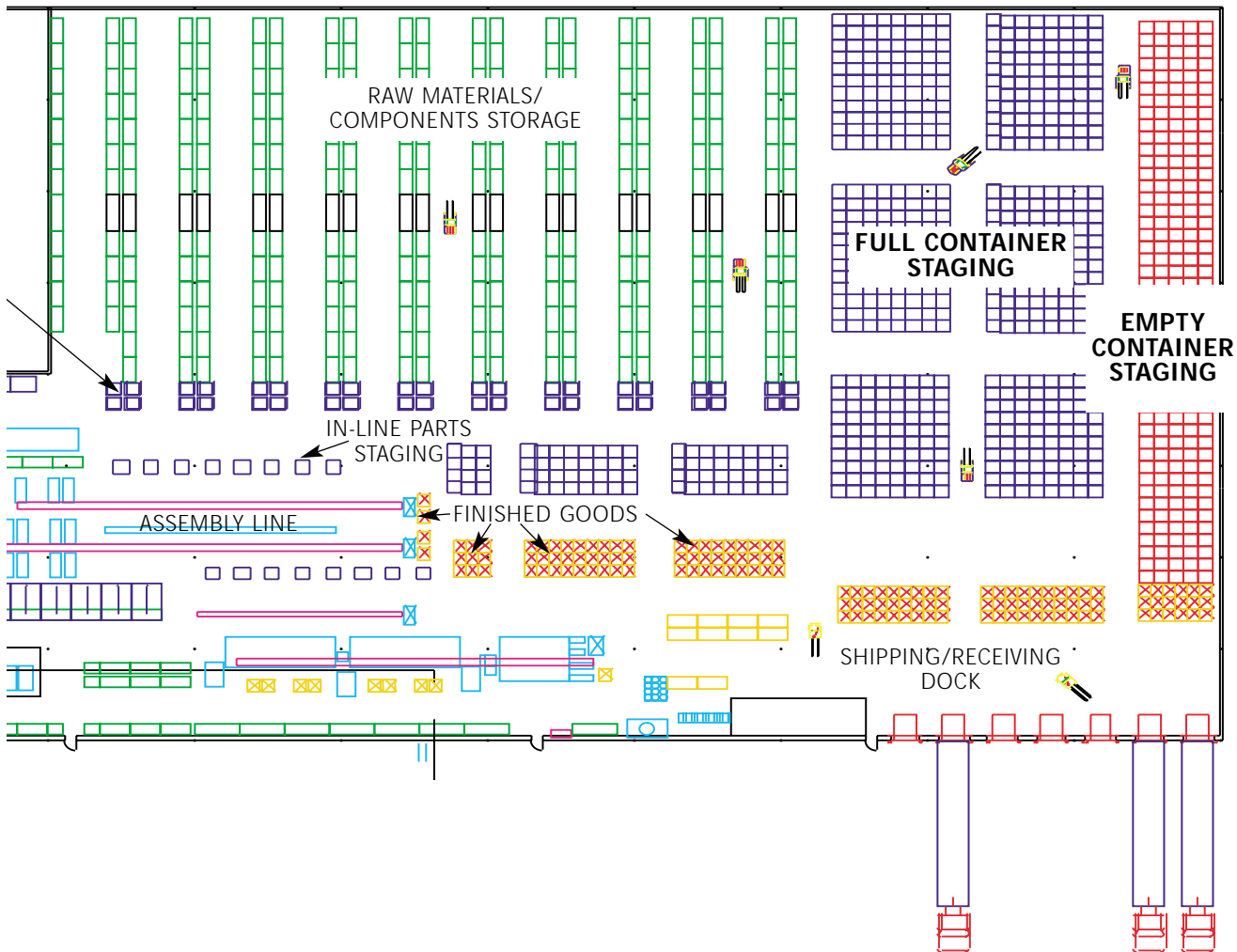
Clear height: 16 ft

Number of SKUs: 75

Throughput: Medium volume

Number of employees: 75

Equipment budget: \$2.2 million



totes & containers



MARC GLOBAL SERVICES

IN TODAY'S COMPETITIVE B2B AND B2C marketplace, businesses are progressively looking to technology to provide a competitive advantage. While technology alone cannot reap these rewards, technology combined with experts knowledgeable of systems and operations can.

MARC Global Services is a leading Supply Chain Execution (SCE) systems integrator providing integration of leading SCE packages with a proven project management philosophy. MARC Global Services offers integrated solutions to large and mid-sized companies that recognize e-fulfillment, warehousing, distribution or discrete production as a vital part of their core business. With strong vertical market knowledge and domain expertise, MARC currently provides fulfillment of every third book you see in a retail bookstore.

For distribution environments, we offer a premier SCE solution based on the MARC product suite with its best-of-breed warehouse management system, MARC-CS, and a host of complementary products that support value-added services, labor standards, customs, billing, mechanization control and visibility into MARC-based operations via checkMARC.net. The MARC product suite can go from traditional distribution to the new ebusiness fulfillment models. MARC's Internet-centric, web-based architecture provides global visibility of fulfillment operations while incorporating flexibility and configuration tools that allow for quick reaction to new and changing business models. In addition, MARC-eXchange Manager provides an enhanced architecture to support business community integration.

MARC Global Services is engaging change across the supply chain with its technology and expert knowledge of systems and operations.

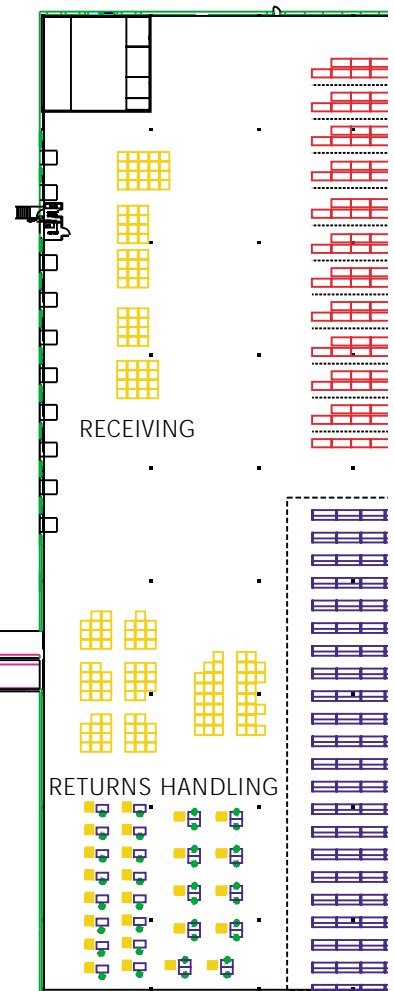
Contact us at 1-800-876-3667 or visit our Web site at www.marcgs.com

Circle 704

Books and entertainment

A WMS and a flexible layout optimize order handling at this extremely high-volume DC

- For maximum picking throughput, the fastest movers (only 1% of SKUs) are located in carton flow racks equipped with light displays
- The WMS captures current order information to automatically assign specific SKUs to the pick-to-light and put-to-light picking areas
- Through constant monitoring of all picking areas, the WMS can adjust work flow on the fly by releasing work into certain areas and not others, maximizing productivity and picking throughput
- Rather than batching all orders regardless of profile, WMS determines the most effective grouping and picking strategy for each incoming order—ensuring that each order is handled in the quickest, most cost effective way
- WMS ensures timely replenishment of stock to forward picking areas by monitoring a predetermined trigger level
- A labor standards module is offered with the WMS to measure and monitor worker productivity
- Wrist-mounted scanners allows hands-free data collection in order picking
- Dedicated areas within the DC ensure efficient handling of returns and orders to be gift-wrapped, both of which can be time-consuming, costly activities



design plans & ideas

This facility is designed exclusively with E-Commerce customers in mind. A WMS provides excellent control over inventory and operations, particularly in managing work flow in order to avoid bottlenecks and optimize picking productivity. To further maximize picking throughput and efficiency in this facility, stock is located by activity level and order type, and picked by order characteristics. The fastest-moving items—which account for only about 1% of the 1 million SKUs handled here—are located in a

multi-lane, pick-to-light area consisting of flow racks equipped with light displays. High-volume orders from retailers are picked in a put-to-light system, whereby orders are picked off conveyors and put on to store-specific shelf locations. Slower-moving SKUs and small line orders are batch picked from shelves using RF pick carts. A special area has been established to handle returns, as has

FACILITIES OVERVIEW

Total Warehouse space:

275,000 sq ft

Clear height: 30 ft

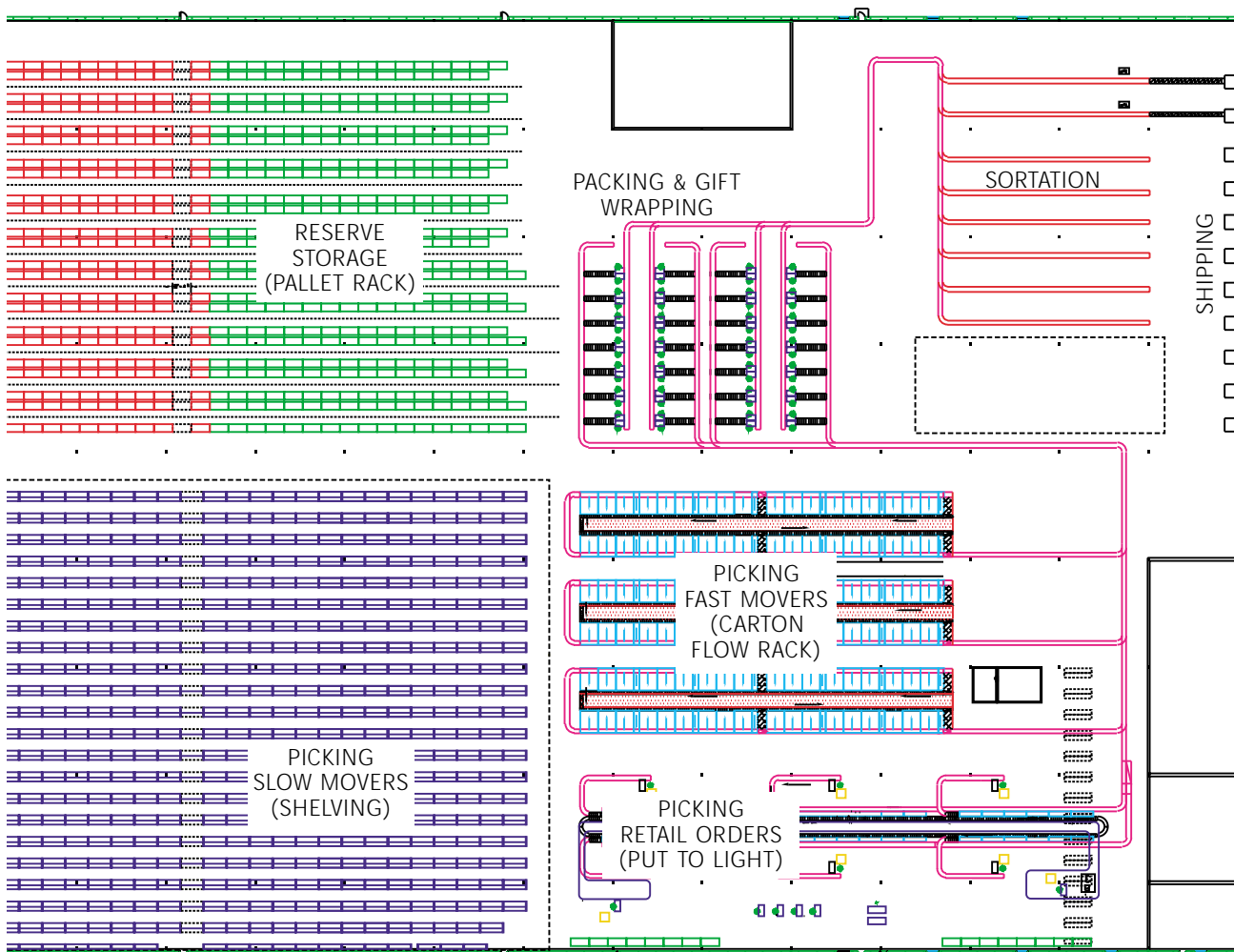
Number of SKUs: 1,000,000

Throughput: Very high volume

Number of employees: 241

Equipment budget: \$8.7 million

a packing area for giftwrapping of orders. Picked items travel by conveyor to a sortation area, where they are sorted by destination and staged for delivery.



WMS