

design plans & ideas

Planning Guidelines for Manufacturing, Warehousing and Distribution

Layouts for

FIVE OF THE WORLD'S MOST PRODUCTIVE FACILITIES

▶ FLAT GOODS/APPAREL DC ▶ FASHION ACCESSORIES RETAIL DC



▶ SPORTING GOODS DC ▶ APPLIANCE ASSEMBLY OPERATION ▶ RETAIL GOODS MAIL ORDER DC

MODERN
MaterialsHandling

 **Cahners.**



design plans & ideas

Planning Guidelines for Manufacturing, Warehousing and Distribution

NOVEMBER 2001

What's inside

WHAT DOES IT TAKE to achieve world-class productivity? Find out in this latest edition of Design Plans and Ideas.

Inside, we take a detailed look at five of the world's most productive manufacturing and distribution facilities. From the use of storage and staging and dock equipment to returnable containers, industrial trucks, and warehouse management software we'll examine how they employ materials handling equipment and strategies to get the goods out – on time and error-free.



Flat goods/apparel DC 8

Streamlined handling and a fleet of industrial trucks help this facility keep the orders moving quickly and efficiently

Fashion accessories retail DC 10

A WMS system gives this facility the information it needs to ship thousands of orders per day on time and error-free

Sporting goods DC 12

Segregation of SKUs by product type and activity level within several picking areas is this facility's secret to high productivity

Appliance assembly operation 14

Use of returnable containers and a JIT replenishment strategy help this facility kick up the volume and keep customers happy

Retail goods mail order DC 16

Practical handling methods and dock safety equipment help boost throughput during peaks in business

SECRETS^{of the} Top productivity operations

Top facilities strive to keep strategies and systems simple, design them to meet operational needs, and maintain a culture that rewards top performers and seeks to continuously improve



Smart use of materials handling equipment to avoid non-value added labor, including this horizontal carousel that supplies parts to technicians on the assembly line, help MMH Productivity Award winner QSC pump up the volume.

What does it take to achieve a high productivity operation? It may be easier than you think, says John Yacka, a systems designer with consulting company Gross & Associates. “Keep it simple” is his mantra for success.

“People get into trouble when they try to make things complicated,” says Yacka. “Yet, the biggest bang for the buck for many companies is proven, traditional equipment and systems and common sense strategies.”

Even something as simple as slotting stock by activity levels, or intermixing batch and strict orderpicking in a single operation, can have a dramatic effect on overall throughput and productivity. “Yet sometimes companies overlook simple opportunities in favor of more complex solutions that can be difficult to implement and challenging to manage,” says Yacka. “Not to mention more cost-

“If you want high productivity, you have to tailor the design of the facility to the needs of the operation.” – System Designer John Yacka

ly in the long run.”

One company who understands the common sense approach is QSC Audio, winner of this year’s Modern Materials Handling Productivity Award for Manufacturing Excellence.

“One of the goals when we moved to our new operation was to eliminate our inventory and to reduce our cycle times drastically,” says Bob Miegs, QSC Audio director of operations. “One way we accomplished that was to recognize that since we build-to-order here, it’s the order that drives our production. The entire design is built upon that simple concept.”

So Miegs set out to design a streamlined assembly line and the mechanisms to deliver material to the line on demand. Innovations include a horizontal carousel that supplies parts to the production line and assembly pallets with integrated RF tags for tracking products as they move through the production process.

“The value of the materials handling systems and equipment that we have here is not that they are

high-tech or advanced technologies,” says Miegs. “What equipment like this does is allow my labor content to be strictly related to value-add activities. Through the use of technologies like carousels and RFID tags, operators don’t have to wait for materials, hunt for instructions, or move materials by hand. And if you can eliminate those activities, that is how you are going to get true productivity gains.”

Although experts may advise keeping things simple, one thing they are not advocating is a cookie cutter approach.

“I think the most important thing for people to remember is that absolutely nothing is cookie cutter when it comes to materials handling,” says Yacka. “If you want a high productivity operation, you have to tailor the design of the facility to the needs of the operation.”

That much is evident in looking at the five top-productivity operations featured in this edition of Design Plans & Ideas. For example, many of these facilities segregate staging, picking, and replenishment activities by the size, activity level, and other unique characteristics of their SKUs. “It’s pretty commonplace to see several, mini ‘warehouses’ within a warehouse,” says Yacka. “And they are all optimized to maximize the throughput and reduce the cost of handling that particular SKU.”

Yacka calls this process “seg-



Productivity Award winner Drugstore.com boosts productivity with strategies like voice-directed picking, used here for slow and medium moving stock.

menting the operation.” “What facility operators should strive to do is segment the work and design systems that can handle different buckets of the overall operation.”

And don’t underestimate the power of maintaining an appropriate work culture to achieve high productivity and performance. “I am a big believer in the empowerment of employees and in giving them the authority to make decisions on their own,” says Miegs. “It may be difficult at first for some managers, but the payoff is huge.”

FOUR KEYS TO ACHIEVING HIGH PRODUCTIVITY

1. Keep it simple
2. Tailor the design of the facility to the needs of the operation
3. Maintain a culture that promotes and rewards good work ethics
4. Strive to continuously improve

GROSS
&ASSOCIATES

Consultants in Material Handling Logistics
Operations Design for Warehousing, Manufacturing, and Distribution

www.GrossAssociates.com

167 Main Street, Woodbridge, NJ 07095 • 732.636.2666

NISSAN FORKLIFT CORPORATION, NORTH AMERICA

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 (815) 568-0061 or visit us on the Web at www.nissanforklift.com

Flat goods/ apparel DC

Streamlined handling and a fleet of industrial trucks help this facility keep the orders moving quickly and efficiently

- Dedicated receiving docks for individual cartons and full pallets reduce congestion and allows for optimization
- Crossdocking of incoming inventory eliminates handling steps and helps speed orders out the door
- Locating block stacking area for pallets at the receiving dock streamlines handling and reduces congestion
- Highly versatile counterbalance lift trucks perform double duty in both the trailer loading/unloading area and pallet replenishment operation
- Truck-mounted RF terminals boost operator productivity by facilitating directed putaway, picking, and replenishment
- Reach trucks can function in thinner aisles (9 ft) than conventional industrial trucks, allowing for greater storage density
- Reach trucks are provided with such features as fingertip control levers and electronic steering to boost operator productivity and comfort
- Segregating pallet picking by activity level helps to boost productivity and optimize replenishment/picking trade-offs

design plans & ideas

High productivity is the order of the day at this facility, which ships apparel goods in a flat format to retail stores. The strategy of segregating activity by product format (pallet vs carton) helps boost productivity and minimize congestion. Incoming goods in cartons arrive at one dock, where about 10% of the volume travels by conveyor to the shipping dock for immediate loading on to trucks. Incoming pallets are received at a second dock and travel to a pallet storage area consisting of single deep, 9-pallet high rack or a floor staging area for direct picking. Some batch picking is also done in the pallet storage area. Individual cases travel through the facility by conveyor. The facility uses a combination of lift trucks, including counterbalanced trucks for loading/unloading operations and reach trucks in the storage area.

FACILITY OVERVIEW

Product Type: Clothing

Facility Size: 220,000 square feet

Equipment Budget: \$8,800,000

Shifts: 2

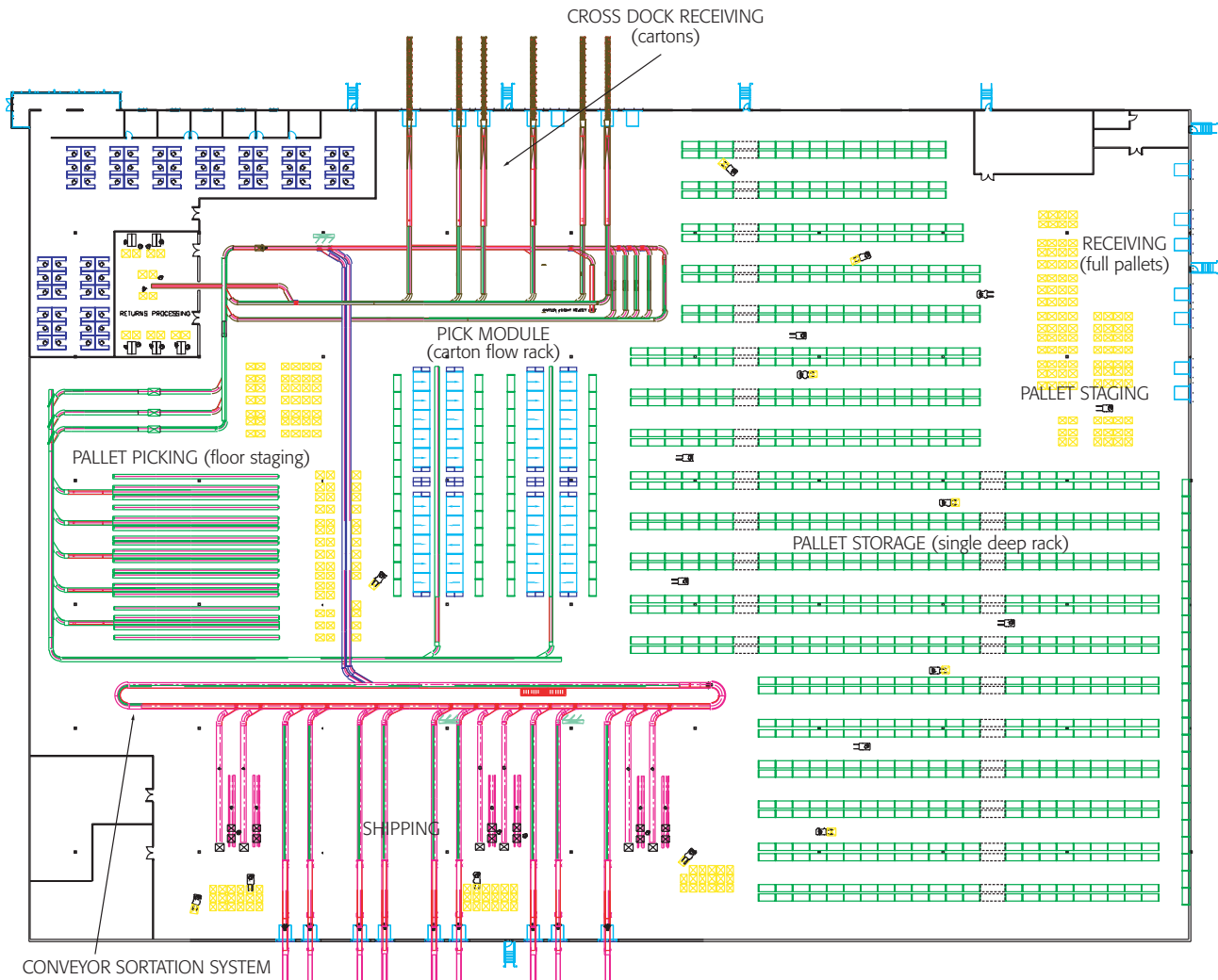
Number of employees: 110 per shift

Clear Heights: 32 feet

Normal Aisle Width: 9 feet

SKUs: 11,000

Activity Level: High volume



industrial trucks



M A R C
Global Services
Supply Chain Execution Integration

MARC GLOBAL SERVICES

IN TODAY'S COMPETITIVE BUSINESS-TO-business (B2B) and business-to-consumer (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 has established itself as a leading Supply Chain Execution (SCE) systems integrator in the global retail marketplace by 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.

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 retail operations such as 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 engaging change across the supply chain by providing proven technology combined with expert knowledge of systems and operations.

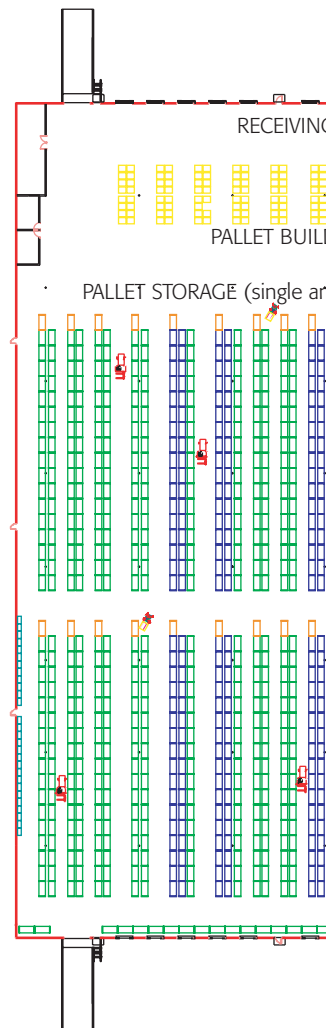
Contact us at 1-800-876-3667.

Info@margs.com or visit our Web site at www.marcgs.com

Fashion accessories retail DC

A WMS system gives this facility the information it needs to ship thousands of orders per day on time and error-free

- Use of an ASN (Advanced Shipping Notice), which gives advance information about incoming orders, allows substantial preplanning for processes and personnel
- The WMS automatically assigns each SKU a random location based on "best" assignment criteria, including merge opportunities, order allocations, travel paths, and velocity
- Intermixing of double-deep and single-deep pallet racks within the same storage/staging area promotes higher storage utilization when stock activity levels vary
- High-productivity, two-level case pick module with dynamic and scheduled replenishment automatically generated and assigned to available personnel can be expanded to three levels if volumes increase
- Establishment of forward pick areas for high-speed, high-demand picking, fulfilling multiple orders simultaneously from a single location
- WMS automatically assigns orders to most appropriate pick areas using a variety of criteria, taking into account UOM configuration, inventory levels, travel paths, and "close proximity" of personnel and equipment
- WMS integrates requirement for VAS into the pick process and routes picked accordingly
- In order to optimize productivity, eliminate bottlenecks, and level out work volumes for operators, WMS evaluates workflow on the fly



design plans & ideas

High-throughput is the name of the game at this facility, which fills thousands of orders daily for retail stores. Incoming goods arrive on pallets, or in overseas containers, which are broken down and stacked onto pallets. A WMS maintains tight control over operations. Each pallet receives a barcoded identifying license plate, and is automatically assigned a random storage location in the pallet storage area, consisting of six-high single and double deep pallet racks. Replenishment pallets feed both the two-level case pick module, as well as the put area, where product is batch-picked to fill high-volume orders. Completed orders travel in totes to the packaging area. Some totes are first routed through a value-added area, where price tags or gift wrap are added. Cartons then travel by conveyor to a sortation area, where they are diverted to the appropriate shipping lane for delivery.

FACILITY OVERVIEW

Product Type: Fashion Accessories

Facility Size: 400,000 square feet

Equipment Budget: \$13,600,000

Shifts: 2

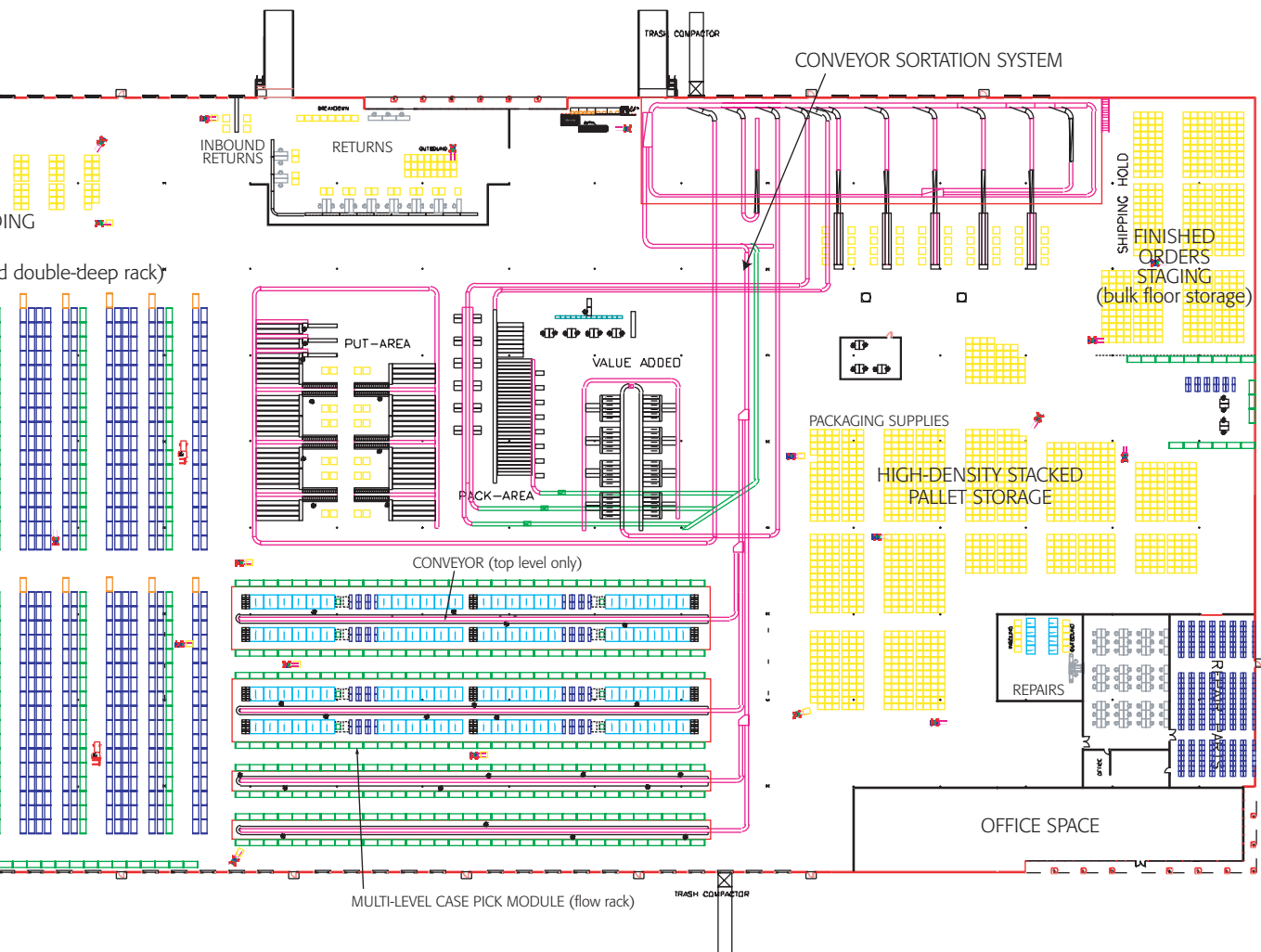
Number of employees: 230 per shift

Clear Heights: 40 feet

Normal Aisle Width: 10 feet

SKUs: 30,000

Activity Level: High volume



WMS



MAKING STORAGE NEEDS A REALITY

GROWTH IS ALWAYS GOOD, BUT IT CAN POSE headaches for warehouse managers trying to make do with existing resources. That was certainly the case for Wilson Sporting Goods. Working to manage a hefty 67% growth in the number of units shipped over the past five years. Worldwide Logistics Director John Wade had done virtually everything he could to wring excess capacity out of the company's national distribution center in Nashville, TN. "Having made the decision previously not to add brick and mortar, we were ultimately forced to go to outside storage, which naturally incurred additional handling costs," recalls Wade. Wondering if there might be a way to bring the storage back inside economically, Wade began to examine alternative to the 11,000 pallet locations of single-deep, static pallet rack used to house pallet loads of finished products. "An obvious answer was to eliminate the aisles," says Wade.

That is when Creative Storage Systems was brought in to design a storage system to accommodate Wilson's SKUs. An evaluation of the existing facility's layout, lift equipment, and the applicable finished goods package sizes and weights allowed the creation of a dynamic staging system in which all unit pallet loads regardless of their weight flowed in a controlled fashion.

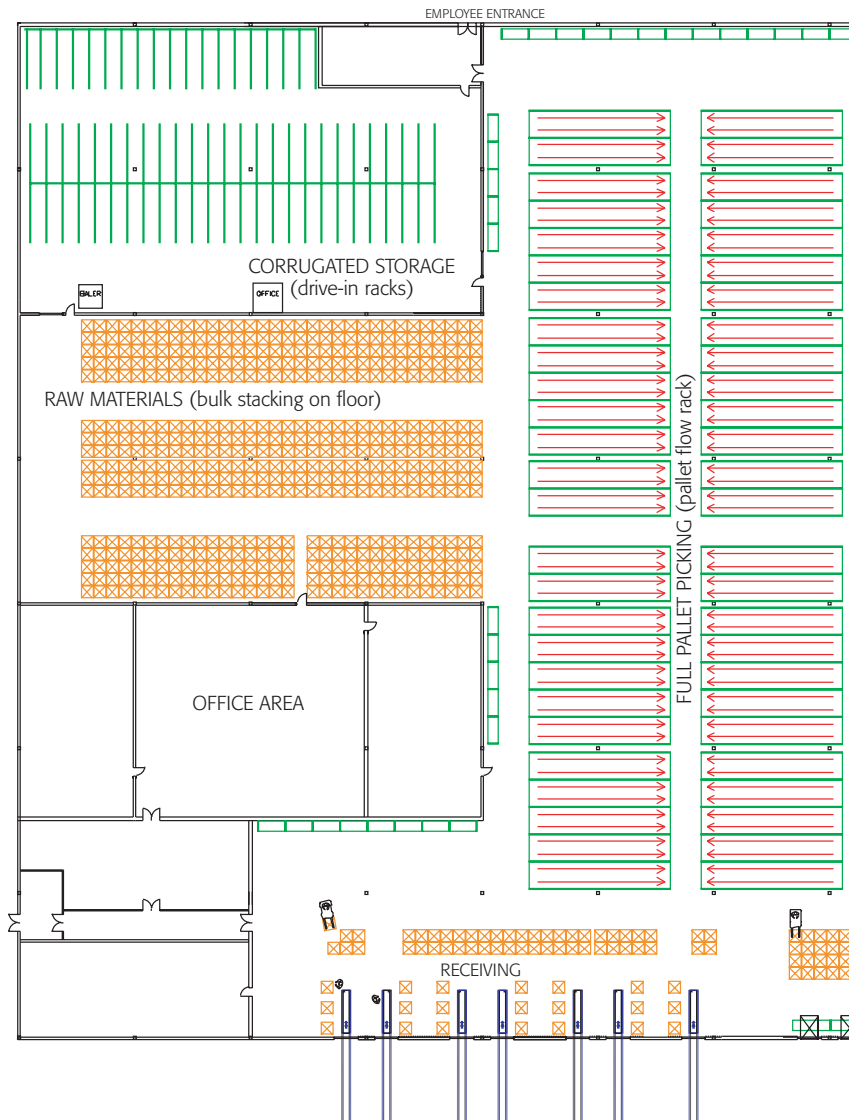
Each lane houses a unique SKU. The fact that Wilson has large volumes of relatively few SKUs allowed for deeper than usual flow lanes, which has a positive impact on throughput.

Wilson reports an astonishing 30% increase in order throughput. "It's great, both our picking and putaway productivity has increased, and we're saving big on storage space," says Wade. He also notes that the new system has helped to speed cycle counting as well as improve inventory accuracy. "Our employees used to dread cycle counting," says Wade. "Not anymore. Now it's easy because we have 15 pallets in one location."

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

Sporting goods DC

Segregation of SKUs by product type and activity level within several picking areas is this facility's secret to high productivity



design plans & ideas

High throughput and quick inventory turns are the major goals of this fast-paced distribution center, which ships sports equipment to retail stores. Incoming product from an adjacent manufacturing operation is received on pallets. These are taken either to the pallet picking or replenishment area (approximately 85% of orders move in pallet quantities) or directly to the replenishment area that feeds a case picking operation, where mixed pallets are built. The facility maintains a separate picking and shipping area for a line of specialty sports equipment. Full pallets are staged at the shipping dock for delivery. True to its goal, the facility averages about 18 turns per year – thanks to a tightly managed operation designed for streamlined handling. A combination of floor storage, pallet and case flow rack, and single-deep storage racks are key to its success.

FACILITY OVERVIEW

Product Type: Specialty sports equipment

Facility Size: 150,000 square feet

Equipment Budget: \$3,450,000

Shifts: 2

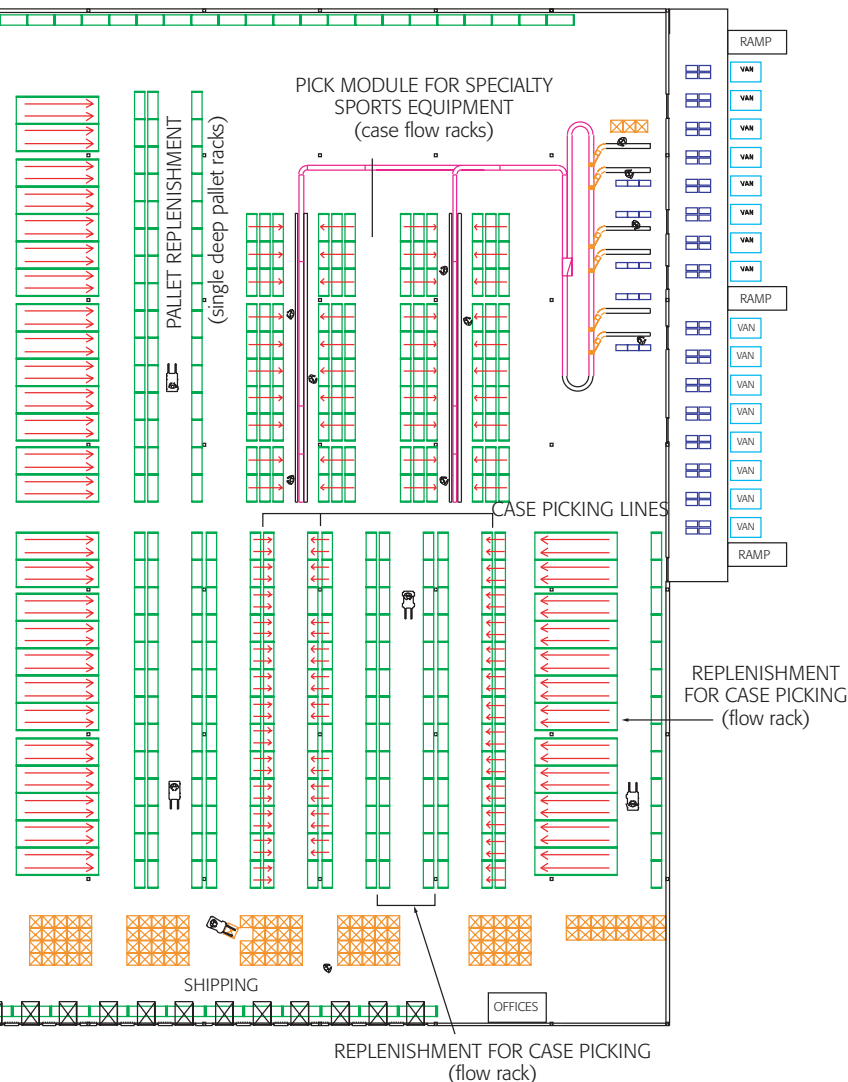
Number of employees: 75 per shift

Clear Heights: 30 feet

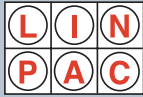
Normal Aisle Width: 10 feet

SKUs: 2,500

Activity Level: High volume



- Use of 8-deep pallet flow rack for pallet picking enables the facility to maintain strict FIFO stock rotation of a seasonal product
- The 8-deep pallet flow rack also provides extremely dense storage, consolidating the high-volume picking operation into a relatively small area
- Additional half-aisle of pallet flow rack (4 deep) is ideal for picking of SKUs that move in pallet-quantities but do not require the depth of inventory of faster-moving items
- Locating replenishment racks (4 pallets high) adjacent to active picking lanes cuts down on travel distances and times
- Judicious selection of storage/staging equipment and the layout results in a better ratio of storage space to aisle space
- Three-level case flow rack ensures FIFO rotation of product and presents a large number of pick faces in a small area
- Locating operations for a specialty sports equipment line within the same facility, saves costs through sharing of specific resources (labor, information systems, etc.)
- Should the balance of pallet and case picking volume shift, the case picking area can be mezzanined to increase capacity



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 in stacking and all applications. The containers provide excellent product protection with 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 for economical maintenance and lower cost of container ownership. Custom colors, ventilated base, lids, ID plates and other options and accessories are also available to help users streamline and organize their distribution process.

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 (800) 442-4892 or visit our Web site at www.LinpacMH.com

Appliance assembly operation

Use of returnable containers and a JIT replenishment strategy help this facility kick up the volume and keep customers happy

- Staging of inventory adjacent to assembly lines allows for quick delivery of replenishment parts to the assembly line
- Placement of the assembly lines at the center of this facility reduces travel distances for both assembly components and finished goods
- Locating receiving and shipping at opposite ends of the facility results in a streamlined flow of components and finished goods through the facility
- Orienting pallet racks at right angles to the assembly area allows lift truck drivers to run replenishment pallets directly to the line, saving both travel time and distance
- Locating packaging adjacent to assembly cells reduces handling steps and travel times and distances
- Empty containers can be folded flat for staging, reducing the amount of floorspace required
- Containers can be stacked up to six high for minimum floorspace requirements
- To maximize storage density, the 40 by 48-inch footprint containers are available in a variety of heights

design plans & ideas

Productivity at this facility is measured in terms of its ability to build a large number of different types of kitchen appliances (about 3000 SKUs) on 3 lines. The facility builds about 2,500 units daily in flexible work cells. Approximately 40% of the parts required to build these appliances travel to the facility and are delivered to assembly lines in large, collapsible reusable containers. Incoming containers are staged adjacent to the assembly line for quick and efficient JIT replenishment to the line. The remainder of SKUs arrive in pallets and cases and are staged in 4-high, single deep pallet racks. A small amount of finished goods is staged on single deep pallet rack adjacent to the dock area. Completed orders are staged on the floor at the shipping dock for delivery to retail stores.

FACILITY OVERVIEW

Product Type: Kitchen appliances

Facility Size: 105,000 square feet

Equipment Budget: \$1,900,000

Shifts: 1

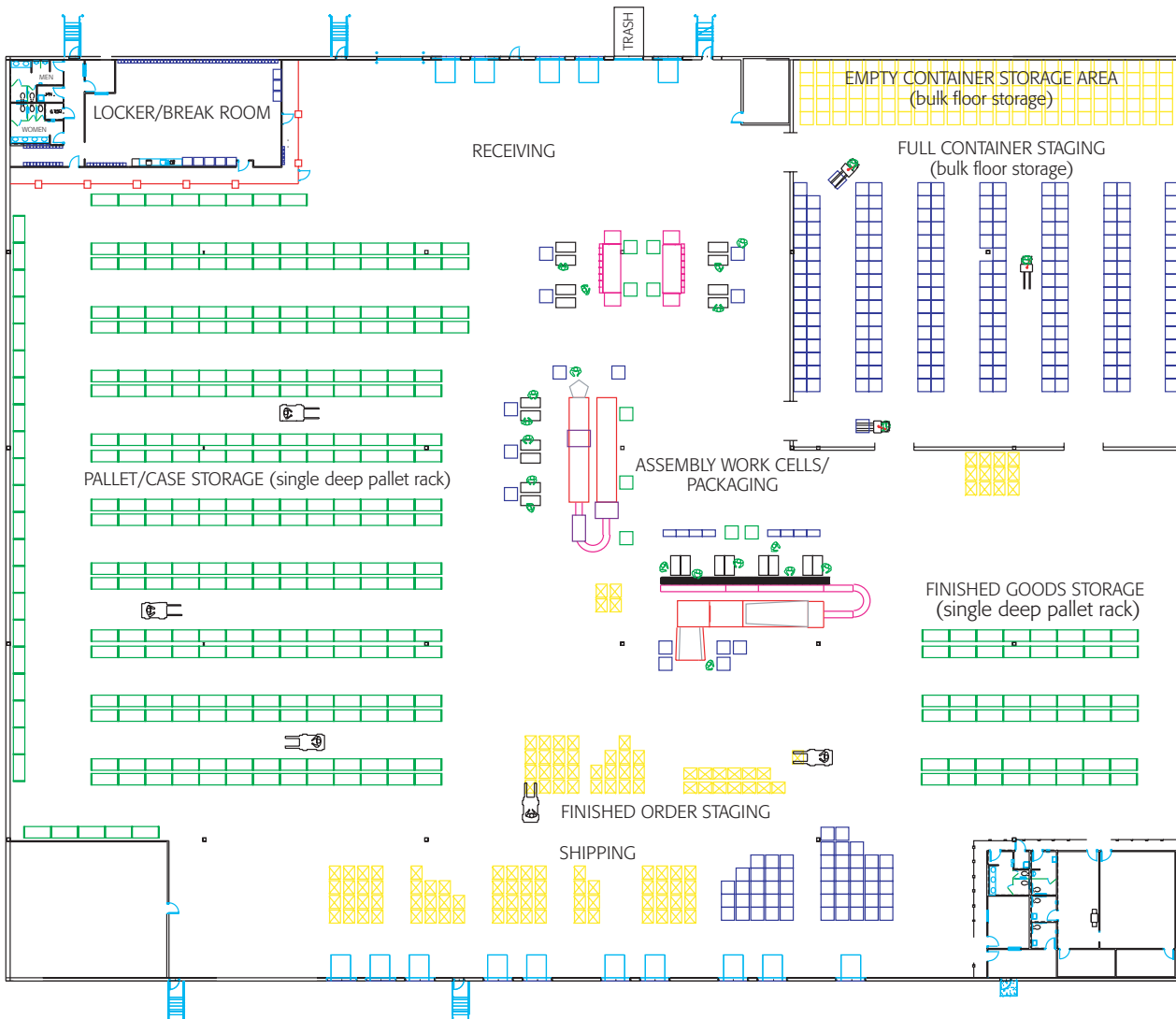
Number of employees: 55

Clear Heights: 20 feet

Normal Aisle Width: 11 feet 6 inches

SKUs: 3,000

Activity Level: Medium volume



totes & containers



SERCO

COMPLETE DOCK SOLUTION FROM SERCO

The **SercO HFC series** combines ease of use with maximum safety. Push button controls provide instant, reliable response to every command. SercO's exclusive two-button control gives the attendant ability to raise the leveler to its maximum range, which automatically extends the lip at any point in the sequence. A large, mushroom-style emergency "E-stop" button instantly freezes the leveler in place and interrupts power to all other functions.

SercO Safety-Loc vehicle restraints™ are available in mechanical and automatic models to suit most industry applications. The rugged, low profile, non-impact design provides predictable performance and a new level of safety, versatility and reliability at the loading dock.



The dual locking arm on the Serco SL series is designed to travel straight up and down – not in an arc – reducing the risk of hooking hydraulic lines, chains or pintle hooks which can prevent a secure capture of the trailer and send false

engagement signals to the dock attendant.

The **SercO S-2200 ULTRA Dock Shelter™** combines the flexibility of a dock seal with full trailer access afforded by a dock shelter. The S-2200 ULTRA Dock Shelter creates a tight seal between the building wall and the back of the truck, providing energy savings and added comfort for dock employees. The S-2200 ULTRA Dock Shelter's unique steel frame design and construction provides strength and durability while also allowing full access to the truck. If an off-center trailer backs into the side pad, it will compress and resist damaged.

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

Retail goods mail order DC

Practical handling methods and dock safety equipment help boost throughput during peaks in business

- Locating receiving adjacent to shipping promotes an efficient U-shaped flow of product
- Flexible hydraulic dock levelers allow the facility to accommodate a wide variety of truck sizes, avoiding bottlenecks and delays
- Vehicle restraint systems promote safety by eliminating the potential for a driver to inadvertently pull away during loading and unloading activities
- For further flexibility, one receiving and one shipping dock are equipped with "Versa Dock," a leveler that offers 9-ft wide access for below dock loading
- Counterclockwise flow of truck traffic at the facility offers truck drivers maximum visibility of the dock when backing their trailer
- Picking from carton flow rack directly to an in-aisle conveyor achieves extremely high picking throughput
- The fastest moving SKUs are set up with multiple pick locations within the pick-to-belt operation
- The picking aisle is intentionally long, so that additional people and pick locations can be added as volumes increase and also to reduce congestion

design plans & ideas

This seasonal mail order DC ships gift items to customers; typical quantity is 1.1 lines per order. Since 90% of this DC's volume occurs in the October to December timeframe, the focus is on obtaining extremely high productivity (approximately 7,500 orders per single shift). Incoming goods arrive in pallets, which are staged in single-deep pallet racks adjacent to the receiving dock. Pallets are used to replenish an extremely fast pick-to-belt operation, consisting of carton flow racks. Picked items travel by conveyor to a packing station, where they are put into cartons and an address label applied. Given its harried pace during the busy season, the DC has paid particular attention to the dock area. It has employed several safety systems, including an advanced inside/outside dock communication system that provides a continuous update of the status of all dock operations.

FACILITY OVERVIEW

Product Type: Mail order/Online Catalog

Facility Size: 70,000 square feet

Equipment Budget: \$2,500,000

Shifts: 1 to 3

Number of employees: 10 to 90 per shift

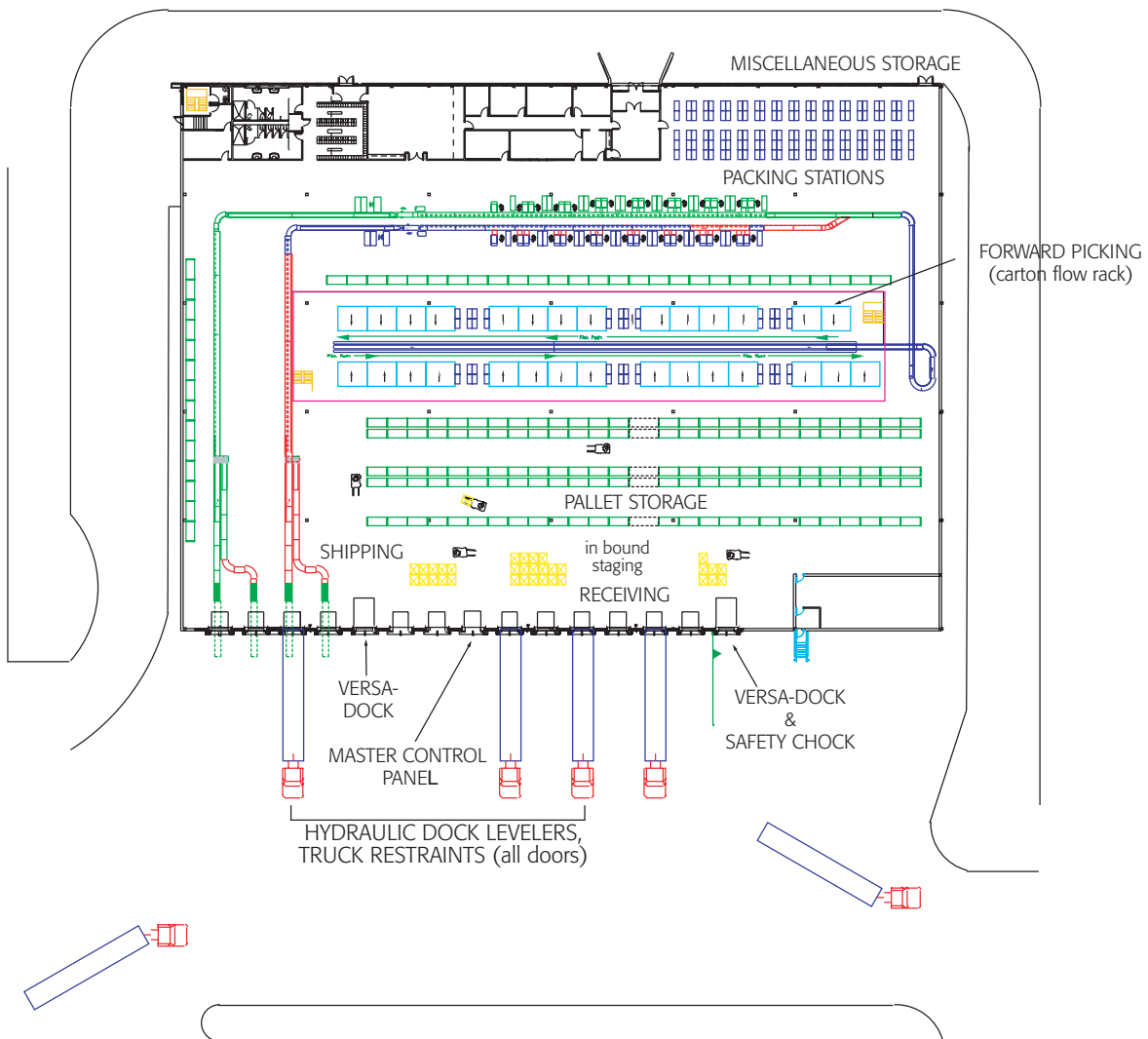
Clear Heights: 24 feet

Normal Aisle Width: 10 feet

SKUs: 500

Activity Level: Seasonal
(Low or High volume)

dock equipment



design plans & ideas

Creative Storage Systems

Phone: (770) 514-0711

Fax: (770) 514-0622

Sercu Company

Phone: (972) 466-0707

Fax: (972) 323-2661

Nissan Forklift Corp.

Phone: (815) 568-0061

Fax: (815) 568-0179

**LINPAC Materials
Handling**

Phone: (800) 442-4892

Fax: (502) 863-5342

MARC Global Services

Phone: (800) 876-3667

Fax: (703) 345-8561

WEB GUIDE

Creative Storage Systems

www.creativestorage.com

Sercu Company

www.sercocompany.com

Nissan Forklift Corp.

www.nissanforklift.com

LINPAC Materials Handling

www.LinpacMH.com

MARC Global Services

www.marcgs.com