



A GUIDE TO PALLET HANDLING

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 Cisco-Eagle

OPTIMIZE EFFICIENCY & ERGONOMICS

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HANDLING PALLETS: THE ISSUES

EFFICIENT PALLET HANDLING MAKES YOU SAFER AND MORE PRODUCTIVE



“Pallet handling is a challenge for most operations that deal with them. When people interact directly with a pallet and its load, handling and transport can get difficult, complex—and sometimes dangerous. This guide dives into options for transporting, handling, wrapping, moving, stacking and unloading pallets more efficiently.”

—Kevin, Employee-Owner since 2017
Systems Integration



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Handling heavy pallets is problematic

Companies traditionally address the issue by adding more manual resources—more forklifts, more people and more space. However, targeted automation enables faster work with fewer resources.

In this guide, we will cover a broad range of pallet handling topics and issues.

ERGONOMICS & PALLET HANDLING

ERGONOMICALLY LOAD, UNLOAD, TRANSPORT AND USE PALLETS



Pallet ergonomics is critical

Because pallets are handled in most every industrial facility throughout the receiving, putaway, stocking, processing, storage and shipping processes, better handling is critical.

With labor shortages and a growing emphasis on safety, optimizing palletized load ergonomics is essential.

Ergonomics in focus

Companies invest in ergonomics because it makes sense from a number of angles: reduced workers' compensation and injury rates, increased productivity and less labor dependence. Ergonomic challenges directly impact productivity, as good ergonomics also enhances speed and accuracy. The right solutions can address all these factors.

The best ideas reduce the need for workers to adjust their body positions to deal with the palletized loads. There are a number of mechanical and automated solutions that can reduce musculoskeletal stresses while making the process faster.



The goals of ergonomic pallet processes

Palletized loads present multiple ergonomic challenges. Adapt tasks to workers instead of making workers adjust to tasks.

- Pallets are typically stacked, with their loads sat atop each other. Upper, middle and lower cartons occupy different ergonomic reach zones and exert varying pressures.
- Workers must access pallets from various sides, heights, positions and angles—many of which put them into awkward positions that can cause musculoskeletal issues.
- Pallets must be moved through their various processes in the warehouse from area to area, and accessed at different times by different people.

The following pages discuss pallet handling ergonomics across various warehouse and factory activities.

MANUAL LOADING/UNLOADING



MANUAL STACKING/DESTACKING FACTORS



“Automation isn’t ideal for many pallet handling situations, but that’s not your only option. Lift tables, cranes, balancers and rotators boost ergonomics by adjusting the load to the worker, rather than the other way around.”

—Mark, Employee-Owner since 2023
Account Executive



Manual and semi-automated point-of-use solutions can reduce ergonomic stress at a fraction of automation’s cost. Ideal systems position workers ergonomically and improve efficiency. The load should be approximately 30” high when accessed, which aligns with the average worker’s knuckle height. If workers must reach too high or stoop too low, musculoskeletal stress increases, especially when handling, lifting or manipulating objects.

Pallet positioners reduce bending, strains and movement while building or breaking down pallets



Pallet positioners raise, lower and rotate pallets to optimal heights for ergonomic loading and unloading. They automatically adjust as cartons are added or removed.

Use case: Ideal for tasks at fixed locations such as along conveyor lines or as pallets are loaded or unloaded in shipping/receiving areas; anywhere pallets are broken or stacked.

Vacuum systems gently lift and move loads



Lift and position without bending or stooping or carrying at higher handling speeds. Variable handle load length lets operators maintain safe load distances.

Use case: move products to or from pallets, from conveyors, the floor, assembly stations and elsewhere where loads are consistent and throughput is important.

Pallet inverters effortlessly transfer full palletized loads from pallet to pallet



Inverters transfer full palletized loads from one pallet to another without manual restacking.

Use case: Anytime full pallets must be swapped. Replace broken pallets without unloading/reloading; change pallets from one type to another quickly. If you need access to part of the load that is on or near the bottom layer, an inverter handles that with minimal manual handling.

PICKING FROM PALLETS

THE ERGONOMIC ISSUES OF FLOOR-LEVEL ITEM PICKING

Picking from floor level pallets causes injuries and musculoskeletal stress. The issues are so prevalent that OSHA has released specific guidelines on how to reduce the problems.

Pallet picking ergonomic issues



- Workers stoop beneath the beam level to lift cartons or other palletized products. This torso bend forces them into awkward stances and puts pressure on their lower backs as they lift.
- When they bend beneath a beam, workers are constricted and can't stand up straight when they retrieve a carton deep on the pallet beneath a beam and must back away, stooped—while carrying the load.
- Because workers pick front cartons first, they leave a gap where people bend or squat beneath the beam to reach it. Shoulder and back injuries are common in that position.
- Head impacts can happen if they raise into the overhead rack beam.
- Stooping pickers with heavy loads in their hands at a cantilevered angle are in a dangerous ergonomic position. This should be discouraged.



Ergonomic improvement options

Use a set-low beam to elevate pallets

Adding a lower-set beam raises pallet height, making it and its contents easier to reach. This reduces torso bending. Setting your second level beam higher reduces vertical storage space and adds the expense of an extra set of beams per bay.



Frequently rotate your pallets

Regularly turn pallets after the majority of aisle-facing product has been removed to avoid what OSHA terms *load pyramids* that eventually leave the least accessible loads to be picked as the pallet empties.

Use floor positions only for slow movers

Cartons that are picked frequently should not be stored on the floor pallet. While that method results in less optimized vertical space, it protects workers from some of the stresses involved.

Remove pallets from the bay, pick them, then replace



This technique removes the pallet using one of several options, picking it, then placing it back into storage.

- Pallet jacks work for slow moving items in limited situations. They aren't viable for faster moving loads.
- Pallet dollies make every pallet position mobile. Dollies are useful in medium rotation zones.
- Pull out shelves host loaded, full pallets (either on the floor or a beam) and let you pick directly from them. They're easily stocked, picked and restocked.

ERGONOMIC LOAD TILTING



**Tall
Vertical**



**Short
Vertical**



**Long
Horizontal**



**Short
Horizontal**



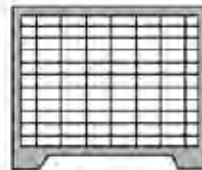
**Small
Random**



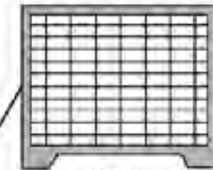
**Small
Organized**

Tilting systems are used for bulk containers. They help establish better ergonomics for workers who pick, place or load.

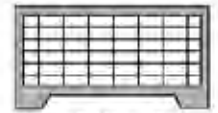
Container types



Large



Large/Drop Gate



Small/Shallow

Containers and ergonomics

Tilters make parts easier and more ergonomic to pick. They tilt loads at varying angles to improve access for assembly and picking. They reduce bending, stretching and reaching—which is desirable when workers pick heavy parts from a container. Most tilters let the operator adjust the tilt as the load shifts.

Aside from ergonomics, tilters increase efficiency and speed. Lifts are built in mobile and stationary variations, with forks or incline table tops to accommodate various container types.

Classifying container loads

Containers of smaller size are more easily accessible. Some larger containers have accessible drop gates.

Container loads can be broadly classified into tall, short, large and small. Those loads can be then further categorized as vertical, horizontal or random. These broad categories cannot fit every load or situation, but the majority of container loads should fit within these broad load descriptions. The size and shape of these loads can be challenging for pickers, which is where a tilter lift can come into play to increase ergonomics.

Load examples

Tall vertical loads include tubes, pipes, bars, rods and similar parts 18" + standing on end at container bottom. Short vertical loads are typically less than 18" tall. Horizontal loads can be bars, pipes, rods, etc. Long loads occupy the majority of container bottoms. Organized small loads are stacked or placed squarely (like cartons). Random small loads are tossed into the container with little or no organization.

The lift you need depends on the load and what you're lifting. Larger, heavier loads require a different container and lift combination than smaller, loose ones. When tilted, these load types will all move differently in the container.



PALLET TRANSPORT: MANUAL

MUSCLE-POWERED PALLET MOVEMENT POSES ERGONOMIC CHALLENGES

Facilities that don't use forklifts move pallets by other means—pallet jacks, stackers, dollies or tuggers. For forklift operations, intermediate transport still occur when forklifts unload truck trailers to staging, storage, processing or other functional areas. What are some manual pallet movement options and their limitations?

Stackers: manual and powered

- Walk-behind stackers remove the burden of moving pallets with muscle power and generally are an ergonomic transport method that allows you to move pallets around a warehouse. Most models can raise or lower pallets to allow cartons or other loads to be accessed from more ergonomic heights.
- Stackers can be powered (which uses motor power to move loads) or manual, which allows manual load pushing. Manual stackers are fine for lighter weight loads, and tend to have relatively lower capacities (1,000 pounds is standard). Power stackers allow up to 3,000 pounds, but propel the load so that workers don't have to push it.



Pallet dollies



- Pallet dollies let workers maneuver and transport pallets.
- Park dollies beneath a rack with a loaded pallet to improve ergonomics for reaching cartons beneath a rack beam.
- For transport, dollies with enlarged middle rollers create a center tilt dynamic that allows easier turning.
- Dollies work for loads of 3,000 pounds or less. OSHA's recommendation of no more than fifty pounds of push force should be applied for dollies as it is for pallet jacks.

For pallet jacks, load assessment is critical

- If the load is too heavy—a push force of greater than fifty pounds according to OSHA—it should be split and transported separately. Use powered pallet jacks for where heavy loads are the norm.
- Pushing is more ergonomic than pulling because it uses the operator's body weight. When workers pull a pallet there is risk of being struck by the moving load. Make sure pathways are visible when pushing.
- Remember the simple push test: if using a pallet jack causes the operator to strain to move the load, the load is too heavy and could result in muscular stresses or injuries.



Above: for heavier loads (above 50 pounds push force) use powered pallet jacks where possible. Two people can transport the same load in cases where loads are extremely heavy.

REDUCING LOAD DAMAGE

WAYS TO REDUCE CRUSHED OR PUNCTURED PALLETIZED LOADS

How can you reduce the chances of forklifts damaging your product?

More pallets and loads are damaged by forklifts than all other sources of damage combined. What are the ways this happens?

- **The forklift mast crushes the pallet or the load.** When a forklift picks up a pallet, it can crack the boards or even damage the load. This damage not only destroys a pallet, it can harm the load. Even if the load isn't damaged by the initial contact, damaged pallets are less stable and more likely to give way and harm the load, or contribute to a pallet rack collapse.
- **Forklift tines puncture the load or its container** when forks aren't aligned. Forks can puncture or crush loads. They can even push it off the rack, or push all or part of the load off.
- **The load slips off tines.** This is often an issue when the forklift works in a cooler or freezer, outdoors or in wet environments. Dropped, loads can be damaged or strike a nearby worker.
- **The pallet is damaged.** If your forklifts damage pallets, drops or crushed loads are more likely.

Damage mitigation techniques

- **Training and education**—drivers aren't always trained to handle pallets gently. In busy operations, they're in a hurry all the time, and enter the pallets too fast. Instruct drivers on techniques that prevent pallet/load damage.
- **The pallets are wrong**—either the wrong size or the wrong fit for your forklift type or the product you're storing.
- **Your load**—isn't adequately wrapped, squared, balanced or built. Poorly made loads are damaged more often.
- **You're over-handling the load**—if your operation handles pallets more than it needs to, damage chances increase. Can you find ways to handle loaded pallets less often?
- **Install forklift bumper pads**—these pads cushion the load and defend against damage. Bumpers don't replace training, good load handling techniques and proper picking operations, but they do enhance them and provide a margin of error.

Technologies to consider

- **Wireless camera systems** improve visibility in areas drivers typically can't see. Cameras can be mounted on the back of the forklift as a back-up camera, on the overhead guard or on the carriage so the driver can see the forks line up with the pallet.
- **Tilt indicators** help counterbalanced forklift operators ensure their forks are level before picking up or setting down pallets to reduce damage potential.
- **Laser alignment systems** visually guide forklift drivers as they pick or store pallets, significantly reducing the chances of tines breaking open bags, punching holes in cartons and damaging the goods inside.
- **Forklift-mounted collision sensors** help make drivers aware of objects and pedestrians behind them by using light signals and an audible alarm. This can prevent rack damage or pedestrian accidents as well as mitigating load drops due to impacts.



EMPTY PALLET HANDLING

Empty pallets can be a problem

According to OSHA standard 1917.14, "Cargo, pallets and other material stored in tiers shall be stacked in such a manner as to provide stability against sliding and collapse." This covers a lot of ground, including the way they are stacked.

Never stack pallets crookedly, or in varying sizes

If your pallets are in poor condition, if they aren't uniform in size and if they are stacked haphazardly, they can tumble or break.

The point: stack them in very straight stacks, and stay at relatively low heights. You can also employ pallet stacking frames or stacking racks to help stabilize them.

Pallet stacks should be separated by at least eight feet, and should be separated from general inventory by 25 feet. It's better to eat a bit of floor space than it is to create a safety hazard.

Never stack pallets too high



How high is too high? A standard GMA pallet is 48" x 40", is 5-7" from floor to top of deck and weighs 55 pounds. Pallets that size and weight stacked too high are a safety hazard.

The insurance industry recommends a six foot stack, which works better if you're manually handling the pallets. National Fire Protection Association (NFPA) recommends sprinkler system protection for stacks higher than six feet.

Fire code compliance

NFPA recommends that you shouldn't stack pallets within 25 feet of other commodities. The code advises outdoor empty pallet storage when possible.

Plastic pallets are riskier than wood, and should be stacked in quantities of four or fewer. NFPA also advises specially designed sprinkler systems for plastic pallet storage.



Never stack pallets on their sides

Vertical stacking makes handling empties harder and less safe. Stack them flat on the bottom every time. People sometimes lean or wedge vertical pallets between horizontal stacks or against a rack or building column. When the stacks start being pulled, those vertical pallets can tip or fall.



OSHA's stance on stacked pallets

- While there is no specific OSHA code pertaining directly to vertical pallet stacking, inspectors sometimes cite companies who engage in it.
- The issue may fall under OSHA 1926.25(a), under housekeeping.
- If a practice creates a potential safety hazard the rule can be applied to any operation even if not specifically covered.

Never keep or re-use damaged pallets

Pallets with missing boards, stringers or other components, can break under a load, or while being transported. Furthermore, this contributes to rack collapses by creating imbalances on your rack beams. When a pallet is splintered on its ends, it has a good chance of cutting or scraping workers who handle it. When it has protruding nails or fasteners, it's even more hazardous. Damaged pallets can tilt in rack storage, potentially causing dangerous accidents or product damage.

SQUARED AWAY: CARTON QUALITY

SQUARE-CORNER CARTONS FORM STRONGER, STABLE PALLETIZED LOADS

Cartons are critical in the full sequence of warehousing operations, but are frequently overlooked when it comes to palletization. Out-of-square cartons can cause issues up and down the line. They stack poorly, may not convey well and could cause product damage or spilled pallets. You could pay higher shipping costs due to carton size, composition or condition.

A square carton is 90 degrees at every corner

Out-of-square cases are 30% weaker than square ones.

- Squared corners allow you to use more of the carton space and make your packing team's job easier.
- Square boxes align better pallet-stacked. When the corners of stacked cases align, they support more weight.
- Square pallets stack better and are less likely to collapse or fall apart during transport, storage or processing.
- Stronger carton stacks are easier to wrap and less likely to overhang the pallet. Good cartons suffer less transport damage.
- Forklifts can damage bulging or overhanging cartons.

How to build square cartons



- **Manual case erection** works for lower volumes. As volume increases, your team might need to form cases in advance of a big rush—which eats up space.
- **Fully automatic case erectors** interact with other equipment to provide a steady stream of perfect boxes. They require more time investment than other options, and they almost certainly won't be the least expensive option. Two factors make an operation a good candidate for a fully automated system: very high volume and fairly uniform case sizes.



Between manual methods and a fully automatic system, semi-automatic case erectors provide consistently square cases, without the same investment as full automation. If your volume is low-to-moderate, semi-automatic case erectors and sealers are recommended. A volume of about 500 cases a day is the range for semi-automatic solutions.

Tips for creating sturdy, palletized loads

- Avoid overhang. All boxes should sit within pallet dimensions.
- Arrange cartons as close to the edges of the pallet as possible. This makes strapping and stretch wrapping easier and more effective.
- Stack heavier cartons on the bottom layer for a stable base and to avoid crushing the lower layers of cartons or other loads.
- Think cube, not pyramid. If you have a mixed case sizes, incorporate the smaller ones rather than stacking them on top in a triangle pattern. A pyramid is less structurally secure than a cube. Your upper layers are never wrapped as well as the lower ones.
- Aim for even weight distribution. Pallet rack capacities assume evenly distributed loads, and individual pallets are more stable when they're evenly-loaded.
- Add stabilization. Using sheets of cardboard between layers can help prevent load deformation.

AUTOMATED PALLET TRANSPORT

PALLET TRANSPORT IS LABOR-INTENSIVE AND SPACE-HUNGRY

Conveyor, AGV and AMR investments are significant, with additional costs for integration and software, but may save money over time.

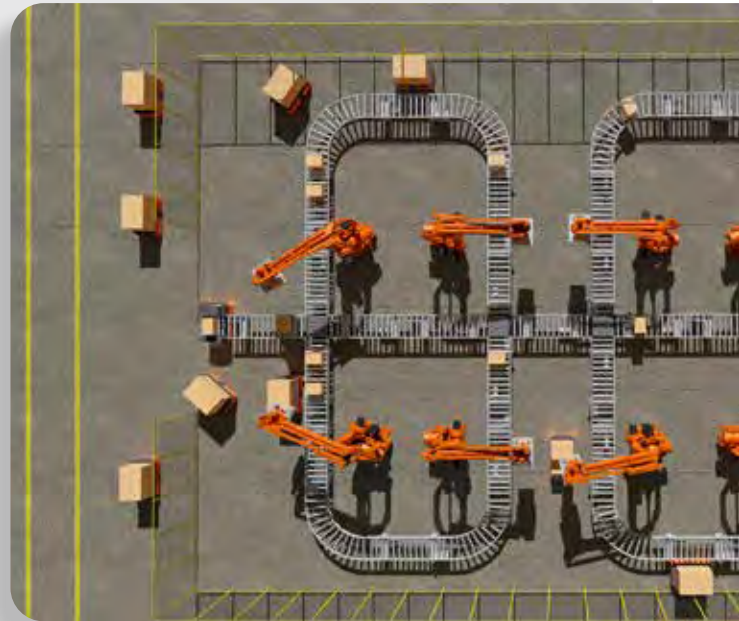
- Pallet conveyors excel in high-volume operations where consistent movement of pallets between fixed locations is required. Conveyors can also feed various assembly stations, packaging systems, palletizers and stretchwrapping systems.
- AGVs and AMRs are more flexible than conveyors, making them better suited for dynamic warehouse environments. While conveyors have better throughput and machine integration, they can function at shipping dock environments and directly load trailers. A fully automated fleet can replace multiple shifts, leading to savings in wages, benefits and training costs.

Safety and accident prevention

AGVs and AMRs use sensors and AI-driven navigation to avoid collisions and minimize these issues. This leads to lower insurance costs and fewer operational disruptions.

Typical ROI for AGVs and AMRs ranges from 18 to 36 months, depending on warehouse size, labor costs and the specific automation. Facilities with high pallet throughput and labor costs see faster payback periods.

Manual handling remains the most cost-effective initially but lacks efficiency, safety and tracking benefits that automation provides. What are the thresholds for automation ROI?



Feature	AGVs	AMRs	Pallet Conveyors	Manual (Forklift/Trucks)
Initial Investment Cost	High (\$50K-\$150K per unit)	High (\$40K-\$120K per unit)	Moderate to high (\$100K+ for large-scale conveyor systems; much less for less complex applications)	Low to moderate (\$25K-\$50K per unit, racking costs)
Operational Cost	Moderate (power, software updates, maintenance)	Moderate (software, power, updates)	Low to moderate (power, rollers, maintenance, spare parts)	High (ongoing fuel, maintenance, labor wages)
Labor Dependency	Low (minimal human intervention)	Low (autonomous operations)	Very low (fully automated movement)	High (requires trained operators)
Flexibility	Moderate (fixed paths, predefined routes)	High (dynamic routing, adaptable to layout changes)	Low (fixed path, limited adaptability)	Moderate (human decision-making, limited by driver availability)
Navigation Technology	Laser guidance, magnetic strips, sensor arrays and guided pathways	AI-driven, LiDAR, vision-based navigation systems	Fixed system (rollers, belts, chains)	Manual operation, driver-dependent
Safety	High (collision avoidance, precision movement)	High (advanced obstacle avoidance, real-time path adjustment)	Very high (eliminates vehicle movement risks)	Moderate (dependent on driver training, prone to human errors)
Efficiency & Speed	High (operates 24/7, consistent speeds)	High (continuous operations, real-time optimization)	Very high (constant flow of pallets, no bottlenecks)	Moderate (speed varies, subject to human limitations)
Maintenance Requirements	Moderate (battery replacements, system updates)	Low to moderate (self-diagnostics, fewer mechanical issues)	Moderate to high (regular servicing required for belts, rollers and motors)	High (frequent maintenance, wear and tear)
Inventory Control	High (integrates with WMS for real-time tracking, reduces lost pallets)	Very high (AI-driven tracking, real-time data sync with WMS)	High (integrated tracking via barcode/RFID scanning)	Low (prone to human errors, misplaced pallets, manual tracking)
Security	High (access control, restricted zones, recorded movement logs)	Very high (AI-driven monitoring, advanced tracking, integration with security systems)	High (restricted access, fully controlled movement)	Low (risk of theft, unauthorized pallet movement, harder to track accountability)
Best Use Cases	Large-scale warehouses, repetitive transport tasks	Dynamic warehouses, high SKU variety, mixed environments	High-volume, fixed-route pallet movement (e.g., from receiving to shipping or pick lines)	General warehouses, lower volume operations, cost-sensitive businesses, dock infeeds
ROI Timeline	18-36 months	12-30 months	12-48 months (high upfront costs, long-term savings)	N/A (continuous labor expenses)

Note: estimates are based on general industry standards and can vary based on specific operational factors. A thorough analysis is required to provide specific values.

TRANSPORT: CONVEYORS



“Pallet conveyors don’t work in every pallet movement situation, but they’re ideal for better transport when they fit the profile. Use them for long, fixed transport runs, assembly or to progressively stacked orders.”

—Gerry, Employee-Owner Since 1993



SPECIFYING PALLET CONVEYORS: THE QUESTIONS TO ASK

Evaluate your load: analysis is critical

- Look at the pallet design (feet, stringers, blocks). Is it a skid? How much does it weigh?
- Other loads—bulk containers, as barrels, drums and others—should be defined. It’s common for these systems to convey large components, work-in-process loads and other heavy items.
- You may think you’re conveying a standard pallet, but look at all its characteristics to be sure you understand them. What way are the runners oriented? Is it a GMA size, plastic or otherwise?

Evaluate your environment

Pallet conveyors are frequently used in manufacturing or processing environments where high temperatures, airborne debris, moisture or oils are present. Define these factors as you explore a conveyor project.

How will you load and unload it?

- Is a palletizer involved? Is it robotic or conventional?
- Are pallets being loaded empty and filled manually or by a robot through the process?
- Are forklifts or other devices placing or picking up pallets on either end of the conveyor?
- This helps you define your needs throughout the project.

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PALLET STORAGE & RETRIEVAL

AS/RS, PALLET SHUTTLE SYSTEMS AND PALLET RACKING



“Pallet storage is always a balance between needs. AS/RS, pallet shuttles, traditional pallet racks or higher density racks, all offer unique benefits... and challenges. Let’s compare these systems and what they can mean for your operation’s space, efficiency and safety. What fits – and what doesn’t?”

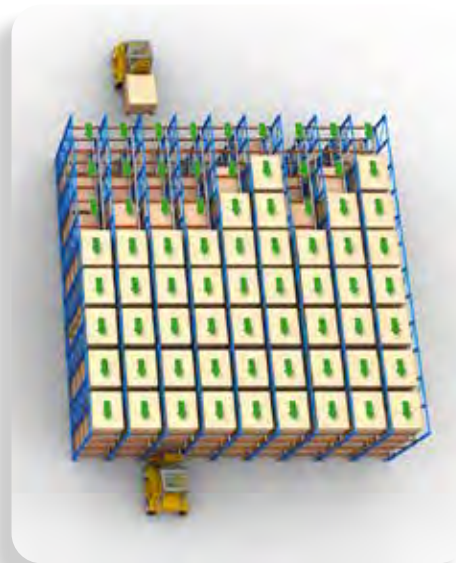
–Mario, Employee-Owner Since 2020



Factor	Unit Load AS/RS Systems	Pallet Shuttle Systems	Conventional Pallet Rack	Higher Density Racks (Flow, Drive-In/Pushback)
Capital Costs	High initial investment due to sophisticated automation and system integration.	Moderate-to-high investment – less than a full AS/RS system but higher than manual racking.	Lower initial investment; cost-effective for the majority of warehouse operations.	Moderate investment – more expensive than basic racks due to specialized racking systems but lower than full automation.
Storage Density	Very high – automated systems enable extremely dense configurations.	High – shuttles allow for dense storage by reducing the need for fixed aisles.	Moderate – requires wider aisles for forklift access, limiting density.	Very high – drive-in and pushback systems maximize storage by minimizing aisle space and optimizing footprint.
Speed of Access	Fast and precise, with automated and accurate retrievals ideal for high-volume operations.	Fast for many applications; shuttles move quickly but may be slightly slower than AS/RS.	Slower – dependent on manual forklift operations and human decision-making.	Slower than AS/RS and shuttles – access can be sequential (e.g., in a drive-in system) or limited to a last-in, first-out approach.
Labor Usage	Minimal labor required; system largely operates autonomously with periodic maintenance.	Reduced labor compared to manual systems, though some operator involvement is needed.	High – significant labor needed for both storage and retrieval using forklifts.	Reduced compared to conventional racks due to optimized storage; however, manual intervention is often required for accessing deeper pallets.
Safety risks	Excellent – automation minimizes human intervention, reducing accident risks.	Very good – with less manual handling, but forklift presence is still necessary.	Good – increased forklift traffic and manual handling increase the potential for accidents.	Moderate – the dense layout can create challenges, and careful management is required to avoid mishandling during retrievals.
Flexibility & Scalability	Highly adaptable for high throughput; reconfiguration may require system downtime.	Fairly flexible; modular design allows incremental expansion with moderate changes.	Highly flexible; can be reconfigured or expanded relatively easily.	Less flexible due to the fixed nature of the design; expansion or reconfiguration may be challenging.
Maintenance & Reliability	Requires specialized maintenance; any downtime can be costly in high-volume environments.	Regular maintenance needed; mechanical components are robust but wear over time.	Simpler technology results in easier and lower-cost maintenance.	Maintenance can be more complex than conventional racks because of specialized mechanisms, yet overall reliability is good if well-managed.



Pallet shuttles are a semi-automated solution that strikes a balance between AS/RS and manual forklift/racking. They improve high storage density by eliminating fixed aisles. While not as fast or precise as a full AS/RS, they improve retrieval speeds and reduce labor needs compared to conventional methods.



Selective racks are cost-effective, moderate storage density storage. Higher density pallet racks such as drive-in or pushback systems maximize storage space by minimizing aisle needs. Racking relies on manual forklift operations for storage and retrieval, resulting in slower access, safety concerns, congestion and aisle space needs.



AS/RS systems demand high capital investment and require specialized integrations and maintenance, but reduce labor usage and increase safety. They're ideal for space-pressed environments where speed, accuracy and throughput are critical. They are the most complex, but also the most automated of pallet storage/retrieval solutions.

PALLETIZING OPTIONS



Conventional (layer) palletizers are ideal for safe, high-speed, high-volume operations.

- **Use case:** Stable and square palletizing of identical products when speed is a critical factor for success.



Robotic palletizers handle multiple SKUs, adapting to different speeds and automation levels.

- **Use case:** Ideal for low to medium production capacity, known for high uptime and superior reliability.

Cobot palletizers palletize lighter cartons in standard configurations, striking a balance between manual and full automation. Cobots cannot handle the range of weights robotic systems do, and cannot match their speed, but are much less expensive and easier to implement for the right operation.

- **Use case: For lighter, lower volume palletizing.** Cobot palletizers occupy smaller footprints than conventional or robotic palletizers, allowing integration into tighter spaces or the connection of more palletizing stations in a given footprint. Pre-connected hardware and software simplify and accelerate implementation, enabling high cycle times.



VIDEO



Shoptalk Video: Cobot vs. fully-automated palletizers.



Manual palletizing is difficult, non-ergonomic and time-consuming but works for some low volume operations.

- **Use case:** Lower volume production with relaxed labor considerations.
- Weigh safety and ergonomic concerns when deciding between manual and automated palletizing processes.

PALLET WRAPPING



“Is there any activity that absorbs more time and gets less consistent results than stretchwrapping a pallet? It’s not easy to correctly, quickly or consistently wrap a pallet. What are your options?”
—Jarren, Employee-Owner Since 2021

shop talk

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Details, pricing and video for automated packaging systems.



Stretch wrap systems: manual, semi-automated or fully automated?

- Fully automatic stretchwrappers require virtually no direct labor. After conveyors deliver the load, the system automatically wraps it, cuts and weighs down the film tail, then transports the wrapped load to a staging area.
- Semi-automatic stretch wrappers offer a range of automation levels—from requiring a lot of operator involvement to requiring minimal operator involvement—depending on the machine’s productivity enhancing features.

Your production and throughput rates determine the case for manual, semi-automatic or fully automatic processes.

When should you manually wrap pallets vs. automation or semi-automation?

- Throughput rates of 30+ loads per hour are needed for fully automatic or stand-alone systems for maximum efficiency.
- However, there are manually-assisted turntable systems that may help lower volume operations.
- Manual wrapping is prone to film tension and coverage inconsistencies, which leads to unstable loads.
- Manual wrapping often results in inefficient film usage and higher costs due to uneven tension and excess application.
- Manual wrapping may also apply too much—or too little—pressure to the load.



CONTAINMENT FORCE BASICS

HUG YOUR PALLETS THE RIGHT WAY FOR SAFER PALLET LOADS

Very light loads:
from 2-5 pounds



Stable mid-weight loads:
from 5-7 pounds



Heavy, unstable loads:
from 7-12 pounds



Very unstable loads:
from 12-20 pounds



Above: Recommended typical containment force ratings for different types of palletized loads. These recommendations are theoretical, and should be confirmed by load testing, product and load evaluations.

Containment force holds your load together in shipping, storage and handling

Containment force is the total force—the *hugging pressure*—applied to a palletized load at a given point. It's produced by wrap force (or tightness) multiplied by the number of stretch film revolutions. Properly contained loads are safer and sustain less product damage and are safer to ship.

Containment force = wrap force x film layers

- Your ideal containment force depends on a number of factors and requires testing and analysis to determine,
- To measure containment force, check three places on a wrapped load to make sure you have the right amount of force throughout the load. Those three places should be near the top, near the middle and at the bottom layer of the load.
- The guidelines above for containment force and load types are theoretical. Real-world loads must be evaluated and tested for safe containment and loading.
- To improve containment force, you can increase either the wrap force or the number of film wrap revolutions.
- If you increase wrap force, you risk the film breaking, so that may not be possible. If the film breaks, or the load twists or shows sign of crushing, you've wrapped it too tightly.
- Adding more revolutions of film can increase costs, so you should try to increase the wrap force first. If that isn't possible, then you will need to increase the number of wrap revolutions.



Measuring containment force

Measure three areas—top, middle and bottom. Each area must meet the minimum containment force needed for your pallet type, load and application. We recommend using a tool to make these estimates, such as Lantech's containment force tool.

VIDEO TUTORIAL

Lantech's containment force tool



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