



Certified in Logistics, Transportation and Distribution

Handling Systems



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Handling Systems

1. Principles of Material Handling

The foundation of all handling systems lies in the 10 principles of material handling—planning, standardization, work minimization, ergonomics, unit load optimization, space utilization, system integration, automation, environmental impact, and lifecycle cost. These principles guide the design of efficient and safe handling processes. Mastering them ensures that handling systems align with operational goals, minimize unnecessary movement, reduce damage, and improve throughput. Understanding how these principles influence equipment selection, layout, and workflow is essential for high-performing logistics operations.

2. Manual Handling and Ergonomics

Manual handling involves human lifting, carrying, pushing, and pulling. Because it is highly labor-intensive, ergonomics plays a critical role in preventing injuries and maintaining productivity. Concepts include proper lifting techniques, acceptable force limits, work height design, tool ergonomics, and repetitive motion reduction. Understanding ergonomic risk factors and mitigation methods helps create safer working environments. It also supports compliance with OSHA guidelines and reduces labor costs.

3. Unit Load Handling

Unit load handling consolidates individual items into a single load—on pallets, totes, crates, or containers—to simplify movement. Benefits include reduced handling time, improved stability, and better equipment

compatibility. Concepts such as load stability, packaging strength, pallet selection, and stacking patterns are key. Understanding the unit load approach is essential for designing efficient material flow and ensuring compatibility with conveyors, forklifts, and automated systems.

4. Pallets, Containers, and Load Carriers

Pallets, skids, bins, and containers are core components of handling systems. Mastery includes understanding pallet sizes (e.g., GMA, Euro, ISO standards), materials (wood, plastic, metal), durability, load rating, and compatibility with handling equipment. Containers—totes, bins, or modular boxes—support standardized handling. Proper selection ensures seamless movement, reduces product damage, and enhances automation efficiency.

5. Industrial Trucks and Forklifts

Industrial trucks—including forklifts, pallet jacks, reach trucks, turret trucks, and order pickers—are essential for flexible handling. Concepts include load center, stability triangle, aisle width requirements, lift height, battery vs. combustion power, and operator safety rules.

Understanding the capabilities of each equipment type enables proper selection and efficient material movement. Mastery also includes maintenance needs, inspection procedures, and fleet optimization strategies.

6. Automated Guided Vehicles (AGVs)

AGVs transport materials along fixed paths using magnetic, laser, or optical guidance. They improve consistency, safety, and throughput while reducing labor dependence. Key concepts include navigation systems, load handling

attachments, traffic management, charging strategies, and integration with warehouse control software.

Understanding AGV limitations—such as limited flexibility compared to AMRs—helps determine appropriate use cases.

7. Autonomous Mobile Robots (AMRs)

AMRs are more flexible than AGVs, using onboard sensors and AI to navigate dynamically. They are ideal for adaptable material movement in e-commerce, assembly support, and order fulfillment. Key concepts include SLAM navigation, fleet management, payload limits, collaborative safety, and scalability. Understanding AMR applications helps design agile handling systems that support rapid operational changes.

8. Conveyors and Transport Systems

Conveyor systems—including belt, roller, slat, chain, and screw conveyors—transport materials efficiently through fixed paths. They reduce manual travel, improve throughput, and support automation. Key considerations include load type, accumulation needs, incline limitations, conveyor speed, system layout, and maintenance requirements. Understanding how conveyors integrate with sortation, packing, and storage systems is essential for smooth material flow.

9. Sortation Systems

Sortation systems—cross-belt, sliding shoe, tilt-tray, narrow belt, and pop-up wheel—route items to their destinations at high speed. They support parcel distribution, order

consolidation, and returns handling. Concepts include sorting logic, throughput capacity, induction points, divert accuracy, and maintenance. Understanding sorter selection based on SKU characteristics and volume requirements is critical for responsive handling operations.

10. Cranes and Hoists

Cranes (bridge, gantry, jib) and hoists enable vertical and horizontal movement of heavy or bulky loads. Key concepts include lift capacity, span, hook height, travel speed, load stability, and rigging requirements. Hoists (manual, electric, pneumatic) provide controlled lifting. Understanding how cranes and hoists reduce manual strain and support specialized industries helps ensure safe and efficient material movement.

11. Pneumatic and Vacuum Handling Systems

Pneumatic systems use air pressure to move lightweight materials through tubes, while vacuum systems lift loads using suction cups. They are ideal for fragile items or clean environments. Key concepts include airflow, pressure requirements, tubing design, vacuum generator types, and material compatibility. Understanding where pneumatic and vacuum handling is appropriate supports automation in specific manufacturing and distribution environments.

12. Automated Storage and Retrieval Systems (AS/RS)

AS/RS systems—miniload, unit-load, shuttle systems, and deep-lane cranes—automate storage and retrieval operations. They optimize space usage, increase accuracy, and reduce labor. Key concepts include throughput

balancing, load interface, storage density, sequencing buffers, and integration with WMS/WCS. AS/RS is critical for high-volume, high-accuracy handling systems.

13. Goods-to-Person Handling

Goods-to-person systems, including VLMs, carousels, shuttles, and robotic picking stations, bring items to operators rather than requiring operators to travel. This improves accuracy, ergonomics, and throughput. Key concepts include workstation design, order sequencing, replenishment coordination, and automation integration. Understanding GTP capabilities supports modern distribution and e-commerce operations.

14. Picking and Packing Workstations

Handling systems include ergonomically designed workstations for picking, packing, kitting, and assembly. Concepts include optimal pick height, reach zones, equipment placement, lighting, and workflow design. Understanding workstation layout affects picker efficiency, accuracy, and fatigue, making it an essential part of handling system design.

15. Dock Handling Systems

Dock areas rely on dock levelers, truck restraints, lift tables, conveyors, pallet jacks, and dock shelters to ensure safe and efficient receiving or shipping. Key concepts include load bridging, trailer height variation, safety equipment, and workflow sequencing. Understanding dock equipment prevents accidents and minimizes bottlenecks at the critical interface between facility and transportation.

16. Load Securing and Stability

Handling systems must ensure loads remain stable and safe during transport and storage. Concepts include stretch wrapping, banding, dunnage, corner boards, tie-down methods, and load center guidelines. Load securing reduces product damage and increases worker safety.

Understanding proper securing techniques is essential for both manual and automated operations.

17. Material Flow Analysis

Material flow analysis studies how materials move through handling systems to reduce waste, travel, and delays. Tools include spaghetti diagrams, time-motion studies, value-stream mapping, and flow charts. Understanding flow analysis helps identify bottlenecks, layout inefficiencies, and opportunities for automation or reconfiguration.

18. Layout and Space Utilization

Effective layouts minimize travel, reduce congestion, and maximize safety. Concepts include aisle width, equipment turning radius, product family grouping, zoning, vertical storage, and flow-through design. Understanding layout principles ensures handling systems operate at peak efficiency and are scalable to changing business requirements.

19. Safety and Regulatory Compliance

Handling systems require compliance with OSHA, ISO, and industry-specific safety standards. Concepts include equipment inspections, lockout/tagout (LOTO), guarding, operator training, emergency stops, and hazard mitigation. Understanding how safety integrates with equipment and

processes is essential for protecting workers and preventing costly accidents.

20. Cost Analysis and System Selection

Selecting a handling system requires evaluating total cost of ownership, labor savings, equipment lifespan, flexibility, scalability, and ROI. Concepts include lifecycle costing, throughput modeling, risk assessment, maintenance planning, and simulation. Understanding economic justification ensures systems align with strategic business goals and deliver value.

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