

CHAPTER ONE

INTRODUCTION

1.1. Definition of Warehouse, Store Keeping, Store House

The scientific management of warehouse is an essential part of the logistics operations. The warehouse management function assumes special significance in every Industry where identity of the materials, then handling, proper storage and accuracy in accounting during issue are of paramount importance in the efficient operation of the warehouse.

Warehouse is part of firm's logistics system that stores products **at** and **between** point of origin and point of consumption. The term "**Warehousing**" is referred as transportation **at zero miles per hour**. Warehousing provides *time* and *place* utility for raw materials, industrial goods, and finished products, allowing firms to use *customer service* as a dynamic value-adding competitive tool.

In some countries the word "store" is used to refer to a retail outlet - such as a "general store" or a "department store" - from which goods are sold, mainly to individuals, who are commonly called "consumers". However, in this course on Stores Management, we define a "**Store**" (with a capital 'S') as: *An area set aside into which all the items and materials required for production and/or for sale/distribution are received, where they are housed for safekeeping, and from which they will be issued as required.*

The term **storage** refers to the physical act of storing the materials in a Storehouse on pallets, shelves, racks, boxes,

almirah, etc. with the objective of retrieving them later for issue to the user. The purpose of any storehouse is to provide to users the ***right materials***, in the ***right quantity***, at the ***right time*** and at the ***lowest possible cost***. Storage is an essential part of the economic cycle and Stores Management is today a specialized function which can contribute significantly to the overall efficiency and cost effectiveness of the materials management.

The various items and materials received into, housed in and issued from Stores are commonly referred to collectively as being '***stock***' (or '***inventory***') hence the use of the term '***stock control***'.

On the other hand the term warehouse refers to a building or room or place where materials are kept. It can also be defined as the Management of operations like Receipt of materials, Efficient Storage, Safe custody, Timely issue, Stock Accounting, Scrap Management and the likes.

A Store might be a department or section of an enterprise, and be its '***Stores Department***'; often that name is shortened simply to '***Stores***' (with a final letter's'). For example, a person might work "***in the Stores***".

In many cases the "Store" might be quite small, perhaps no more than a stock cupboard in a small service concern, such as an estate agency, or a small office. Other enterprises, however, require huge Stores to hold the vast stocks of items, of many different kinds and sizes, which they must have available if they are to be able to run efficiently and

successfully. In between the two extremes, there is an enormous range of different enterprises with Stores of different sizes. Whatever the situation, you will find that the Stores of most enterprises fall within the definition we have given you.

1.2. Objectives of Storekeeping

The task of stores management relates to safe custody and preservation of the materials stocked and their receipt, issue and accounting. The objective is to efficiently and economically provide the right material at the time when it is required and in the serviceable condition in which it is required.

Efficiency in the store starts with precise forecasting and planning of the necessity for materials, and this presupposes that the need itself has been forecast with a considerable degree of accuracy. The forecast also must be subjected to periodic review. The art of stores management is largely that of optimizing the use of resources to meet actual needs in an efficient manner.

Storage objectives are the following.

- a. Maximum utilization of space consistent with adequate care and protection of materials.
- b. Ensuring that all stocks are readily accessible. The storage system has to be such as to enable accurate identification of the materials stored.
- c. Efficient and quick movement of stocks. Ease of storing and picking, thus enabling speedy operations.

- d. Provision of maximum protection to stocks against damage, deterioration and un- authorized usage. All materials must be protected from temperature, moisture, pilferage, insects, rodents etc.
- e. Ensuring proper house-keeping. Environmental Conditions within the storehouse should be conducive in terms of lighting, temperature, ventilation, access to the racks, trade wise stacking.
- f. A very important principle in store keeping is FIFO or First-in-First-out. Most materials have a shelf life and this is specially so in the case of paints, cement, food, etc. The oldest stock has to be issued first.

1.3.Importance of Storekeeping

Warehousing and warehouse management are part of a logistics management system, which is itself a component in supply chain management. Although viewed by some as simply a place to store finished goods, inbound functions that prepare items for storage and outbound functions that consolidate, pack and ship orders provide important economic and service benefits to both the business and its customers.

i. Central Location

A warehouse provides a central location for receiving, storing and distributing products. As each inbound shipment arrives, responsibility for the goods transfers to warehouse personnel; products are identified, sorted and dispatched to their temporary storage location. Storage isn't a static "thing" but rather a process that includes security measures and

maintaining an environment that preserves the integrity and usefulness of the items. Once it's time to move items, each order is retrieved, grouped, packaged and checked for completeness before being dispatched to their new destination.

ii. Value-Adding Operation

The objective of a logistics system is to reduce cycle times and overall inventories, lower costs and most importantly, improve customer service. Warehousing increases the utility value of goods by providing a means to have the right products available at the right place in the right time. Operations such as order consolidation, order assembly, product mixing and cross-docking that take place within the warehouse structure also add value to the overall logistics system.

iii. Economic Benefits

Warehouses provide a economies of scale through efficient operations, storage capacity and a central location. Economic benefits are realized, for example, through consolidation and accumulation operations. Consolidation operations cut outbound delivery costs for both the business and its customers. Instead of shipping items individually from multiple sources, items are delivered to a central warehouse, packaged together and shipped back out as a complete order. Accumulation operations allow a warehouse to act as a buffer, balancing supply and demand for seasonal and long-term storage. This can be vital to business profitability when

demand for a product is year-round but the product may only be available at certain times of the year.

iv. Service Benefits

Warehouses can serve as part of a contingency plan to ensure outbound orders are filled in full and on time. A practice called safety stocking allows businesses to maintain a predetermined number of inventory items at its warehouse. On the inbound side, safety stocking means that an emergency such as a transportation delay or a shipment containing defective or damaged goods won't delay filling and shipping customers order. On the outbound side, safety stocking is insurance against out-of-stock items.

1.4.Functions of Stores Management

The relative function of the stores management function depends upon the nature and size of the organization or activity concerned, and in all cases it has to be designed to suit the particular need of the organization it serves. There is, therefore, no standard system which can be universally recommended or applied, but in the course of time, certain principles and practices of general application have been evolved. The understanding of these principles is essential for efficiently practicing the art of Stores Management.

There are range of activities in managing stocks ranging from identifying the need for a property to materials and supplies to receiving, using and disposing. For clarity and brevity, it is important to identify the typical functions that fall under stock

management and its relationship with other functions in the broader supply system.

The Stock management involves the following functions and activities:

- a. ***Identifying stock***: - this function involves classification and coding of stock.
- b. ***Receiving***: - activities performed in this function include receiving of fixed assets, and stocks from all sources and conducting inspection.
- c. ***Inspection of all receipts from suppliers***.
- d. ***Issue of materials to users within the organization***: - handing over stocks and fixed assets to users departments and outsiders are the activities under this function.
- e. ***Maintenance of Stock record and accounting***: - the major activities under this function are keeping and updating and reporting the record for the movement of stock.
- f. ***Stock taking and stock control***: - this function involves the periodic physical count of stock and fixed assets in storehouses, and ensuring materials and supplies are available when needed.
- g. ***Inventory Control***
- h. ***Materials Handling***
- i. ***Storage and Preservation***: - the proper keeping and preservation of stock and fixed assets while it is in store houses and stock yards.
- j. ***Submission of Management Information Reports***

In performing these functions, there exists relationship with Procurement and users departments/units.

1.5.Principles of Storage

- Only authorized persons shall have access to the Store House.
- Store house shall not be kept open unattended during working hours. All materials will be issued on First-in-First out (FIFO) basis. All materials will be received at the store house and person / department concerned will be notified promptly on receipt.
- All materials should be stacked properly.
- All materials approved after inspection shall be stored in the designated locations.
- Hazardous materials are to be stored separately.
- All materials rejected shall be kept at a designated place and arrangements for their disposal made on the advice of concern purchasing official.
- Expensive and attractive articles should be stored in steel cupboards and always locked up.
- Items issued on loan should be periodically verified with loan records. Capital items must be periodically checked with capital inventory.
- A Gate pass should be made for taking out materials. These should be signed only by authorized persons.
- Uniforms to the trainees will be issued at the time of enrolment on returnable /non returnable basis as per instructions of Director.

- Tool kits will be issued to all trainees on non returnable basis after successful completion of the training as certified by Director CTTI.
- After completion of each batch of training a Board of Officers will be convened trade wise to survey and assess the serviceability of all training stores. The Board of Officers will recommend recoupment of consumable training stores trade wise required for next batch training. They will also recommend disposal action to be taken for items recommended as unserviceable, scrap or Beyond Economical Repairs (BER).
- Training stores declared unserviceable/consumed during the said training period will be replaced after obtaining the approval to charge off/write off from DG, NAC.

1.6.Essentials of Storage

Warehouse performs a number of essential functions. These are:

Creation of time utility: There are products which are produced continuously throughout the year while consumption is seasonal. Storage enables goods to be made available to buyers whenever they are in demand.

Creation of place utility: Another function of storage is to make goods available to a buyer at his place of business when he needs them. It creates place utility by warehouses location, e.g., a retailer can obtain goods within a few hours or minutes by contacting the wholesaler's storage.

Finance function: Storage helps to obtain or raise loans by providing collateral security of the goods stored.

Creation of form utility: Certain commodities improve in quality or desirability while in storage, e.g., curing of tobacco, liquor etc. Thus, storage creates form utility in certain goods.

Stabilizing prices: Another function of storage is to stabilize price by making the goods available in the market whenever there is demand.

Regular production: Storage performs the function of smoothing out irregularities in production, in the present age of competition; every manufacturer tries to produce in anticipation of demand so as to provide free supply in the market well in time.

Ability to Face Natural Calamities: Storage enables the society to face natural calamities such as floods, famine, drought, etc. In such emergencies, commodities can be made available from the storage.

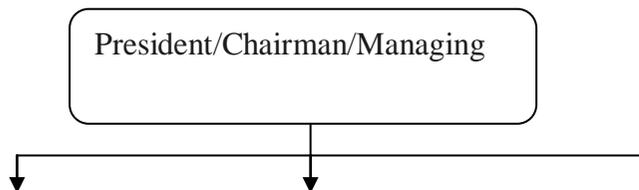
Reduction of Risk: Storage reduces the risk of owner of goods as the owner of goods can store merchandise with reputed warehouses which absorb a part of the risk.

Saving Transportation Costs: Storage allows accumulation of stocks to be transported in bulk quantities; so as to reduce the transportation costs significantly.

Economies of large-scale: Storage enables a concern to achieve the economies of large-scale production, large scale buying and selling, etc. as the goods may be kept in stores.

1.7. Positions of Stores within Materials Management Organization

The major resources in any organization to manage are the materials out of seven main resources required to run any organization. They are management, materials, money, man power, machines, methods and matrix or facilities which include systems, plants, location and buildings etc. The purpose of materials management organization in any industry is to plan the materials requirements for the production of goods and services. The structure of the organization must be such so as to have the efficient management of materials controlling its flow, conservation and utilization. Its objective is to use judiciously and economically. The product must be produced from the available materials purchased at the economic price and bring together under one organizational component sharing responsibilities of all the aspects affecting flow, conservation, utilization, quality and cost of materials. Materials management includes inventory management, purchase management, value analysis, store keeping, maintenance and upkeep of the inventories in hand and in process. A typical Organization Structure for warehouses under materials management is given below:



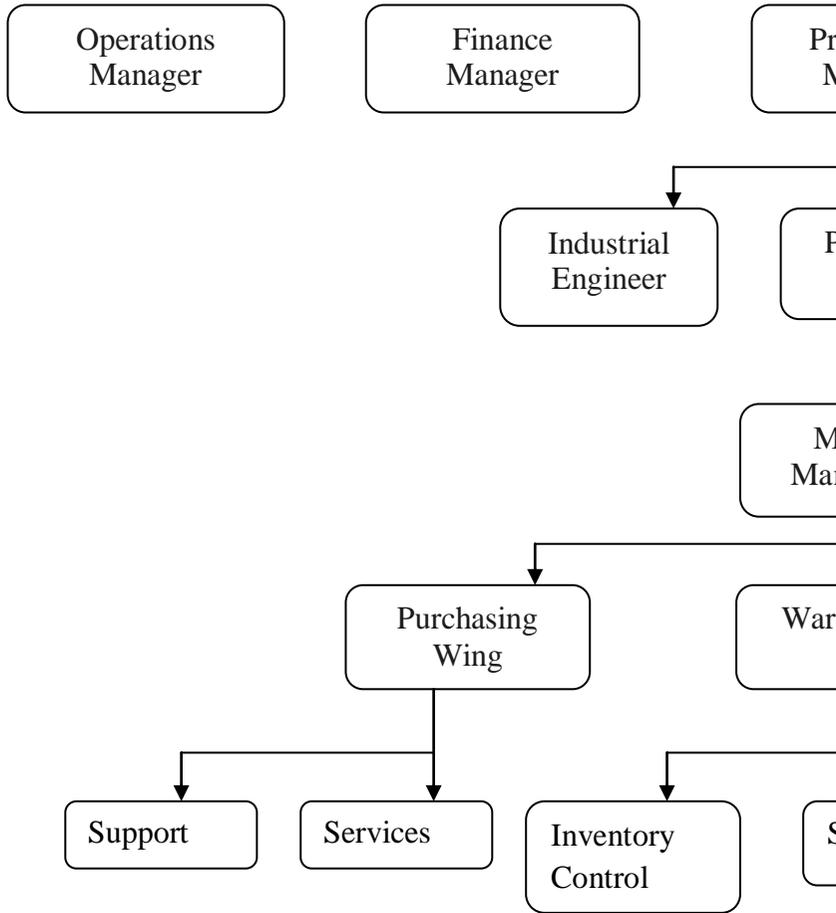


Fig. 1 Structure of Stores management under materials management department

Activity

1. *Define warehouse and materials handling management.*
2. *Identify the major role of stores management to economic development*
3. *What are the major duties and responsibilities of store keeper?*
4. *Explain the major functions of store management.*

CHAPTER TWO

TYPES OF STORES MATERIALS AND CLASSIFICATION OF STORE HOUSE

2.1. Basic Classification of Materials

Stock items in the Store of an enterprise could include any or all of:-

- ✓ raw materials
- ✓ components (parts)
- ✓ spare parts
- ✓ partly finished work (sub-assemblies, work in progress)
- ✓ materials for maintenance
- ✓ consumables
- ✓ tools, jigs and gauges
- ✓ finished products (of the enterprise or purchased from others) ready for sale
- ✓ packaging materials
- ✓ scrap and by-products of production
- ✓ Damaged, substandard or obsolete items and others.

Some items and materials might be solid, others might be liquid, and yet others might be gaseous.

We shall refer to all things held in Stores as '*items*' or '*stock items*' or '*materials*' or '*stocks*'.

2.2. General Classification of Storehouse

The classification of warehouses is very diverse. They are classified by different traits. By storing method: closed, open and half closed. In turn closed warehouses can be classified

by the number of stores (multi-stores, surface and underground) and heat ability. Due to the tendency of saving space, construction of warehouses now tends to rise, warehouse location under the ground, the enlargement of aisles of the supporting structures (for storing large cargo). In the modern construction of warehouses structures out of light alloys are used.

In addition, warehouses can be categorized by class (A to D), depending on such factors as: the quality of roads leading to the site (including the presence of the railway branch), the universality of the warehouse in terms of range of the stored goods, warehouse space and limits concerning the dimensions of the stored goods, the provision of related services, availability of qualified personnel, etc. Also, stores are divided by type of ownership, by type of storage, by location, etc.

Generally, there are different kinds of warehouses and the classification of warehouses can be made from the following viewpoints:

- On the basis of structure.
- On the basis of ownership.
- On the basis of service rendered.
- Storing method
- On the basis of building Forms
- Based on the nature of the items at the storage
- Based on the storage of items

A. On the basis of Structure

Warehouses are built in different ways to meet the special requirement for storage. Different warehouses are constructed for specific goods. While selecting the types of warehouse, one has to take into consideration the factors like the nature of goods, the quality and the climatic condition. From the point of view of structure, the following types of warehouses are found:

- i. Classical warehouse:* It is a big hall of single storey building divided into various big or small rooms to store of general nature.
- ii. Silo:* It is a vertical structure room equipped with mechanical devices. The loading and unloading functions are done through mechanical devices.
- iii.* These are generally in the shape of big tanks or bunkers.
- iv. Bins:* Bins are small cylindrical cabins of different sizes meant to store varieties of products. These are manually operated and provide bulk storage facility.
- v. Elevator:* Elevator is a big vertical premise and are of craned types. These are used for lifting and de-lifting of products. From the elevator goods are directly discharged from wagons.
- vi. Portable warehouse:* It is a type of temporary warehouse which can be removed or set in a short time. These warehouses have enough capacity to withstand rains and winds.

B. On the basis of Ownership

From ownership point of views, there are different types of warehouses:

- i. Private warehouses:* Private warehouses are owned by big business houses like producers, wholesalers and big retailers. These big business houses store their goods in these warehouses. These are not given to outsiders on hire. These warehouses are found in rural and sub-urban areas.
- ii. Public warehouses:* Public warehouses are used by general businessmen on payment of a rent or charges. These warehouses obtain license from the government and follow the specific rules of the government for its maintenance.
- iii. Household warehouses:* These warehouses provide storage facility for household equipments like furniture, rugs, furs and paintings. These warehouses are found in western countries.
- iv. Co-operative warehouse:* These warehouses are organized on co-operative basis and run on joint efforts of the people. These are made in rural areas for storage of agricultural goods. The best example of a co-operative warehouse is cold storage.
- v. Bonded warehouse:* Bonded warehouses are maintained by port trust and custom authorities. These are meant to store imported goods from the foreign countries.

C. On the basis of Service Rendered

From the point of view of service rendered, there are different types of warehouses like:

- i. Specific Commodity warehouses:* These warehouses are meant to store specific goods like cotton, petroleum products and wool. These warehouses are specially constructed to accommodate the above articles.
- ii. Cold Storage:* These are meant to store agricultural products of perishable nature. Perishable goods like fruits, vegetables, eggs and butter are stored in these warehouses.
- iii. Bank warehouses:* These warehouses are maintained by banks to keep goods as securities. The goods received by banks against credits or loans are kept in these warehouses.
- iv. General Merchandise warehouse:* Goods which do not require any special storage facility are stored in these warehouses.

D. On the basis of Storing method, stores can be classified as

The classification of warehouses by storing method: closed, open and half closed. In turn closed warehouses can be classified by the number of stores (multi-stores, surface and underground) and heat ability. Due to the tendency of saving space, construction of warehouses now tends to rise, warehouse location under the ground, the enlargement of aisles of the supporting structures (for storing large cargo). In

the modern construction of warehouses structures out of light alloys are used.

- i. **Closed:** is a closed and protected ware house from every acts of theft, deterioration, damages due to mishandling and the likes
- ii. **Open:** A room or area constructed and operated for the purpose of safeguarding stocks that, because of its size or nature, or operational necessity, cannot be adequately protected by the normal safeguards or stored during nonworking hours in approved containers.
- iii. **Half closed.**

E. On the basis of the storage of items they can be divided into

- ✓ solid form of articles,
- ✓ liquids, and gas goods and
- ✓ powdered goods warehouse;

F. On the basis of the Nature of the items at the storage they can be divided into

- ✓ Storage of raw materials,
- ✓ semi-finished and
- ✓ finished products warehouse;

G. By building Forms stores can be divided into

- i. **Single-Storage:** suitable for storage of metal materials, building materials, minerals, machinery, vehicles, oil,

chemicals, wood and its products. Wharf warehouse, warehouse rail, air transport multi-storey building warehouses to speed up the loading speed.

- ii. **Multi-Storage:** general store merchandise, electronic equipment, food, rubber products, pharmaceuticals, medical equipment, chemical products, stationery, instruments and so on. Should be loaded in the bottom space for discharge, loading and unloading vehicles can enter directly. The vertical transport of goods commonly used 1.5 to 5 tons of freight elevators. Should consider shipping the goods into the cart or forklift able to open the elevator to accelerate the loading speed.
- iii. **Cylindrical-Storage:** General storage of bulk cement, dry ore slag, fly ash, bulk grain, oil, gas and other gases. The architectural design of cylindrical storage items according to the type of storage and into the discharge is determined. Library top and bottom walls and libraries must be waterproof, moisture-proof; the library roof cleaning device should be set. For daily maintenance, to set things hanging hole, one whole (ladder library wall located), the amount of storage holes and lifting hooks and so on.

2.3. Storage System and Methods

Although every company is different and the situations are unique, many of the challenges that businesses face are fairly similar. For example, whether a distributor is expanding an existing location, opening a facility in a new market, adding more products and services, offering new sales channels such as e-commerce or direct-to-consumer, or any other major shift in operations, the same challenge exists; implement the physical

and operational changes without affecting the customer. Operational and physical changes often go hand in hand or at least significantly impact one another. Generally speaking, in a warehouse or distribution environment, physical facility changes boil down to different types of storage media for product handling, manipulation or picking. The most common types of storage come from four categories: Bulk Storage, Pallet Rack, Shelving, and Carton Flow. With the focus on different types of manual storage systems, below you will find how each type is used, some pitfalls to avoid, and ways to keep the equipment like new.

Bulk Storage,

Also known as “floor stacked”, this is the most basic form of warehouse storage and consists of no physical storage medium other than building square footage. Products are stored directly on the warehouse floor typically arranged several pallets deep and possibly stacked depending on product type. This method offers low cost and is ideal when pallets are stackable, ceiling height prevents vertical racks, products are not sensitive to (FIFO) First-In First-Out sequencing and storage density is not a concern. Challenges include low space utilization (60-70%) since the vertical space is not effectively used, increased possibility for product damage due to stacking, and inefficient product locating and picking due to cumbersome product access and poor product location identification.

Pallet Rack,

A common warehouse storage technique, pallet racking utilizes racks so that goods can be stored in multiple levels

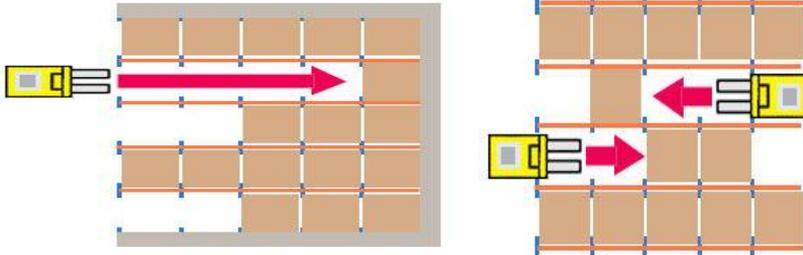
above the ground. This makes better use of available space. Rather than being limited to the storage of just one pallet, the racking system allows for stacking of up to four or five levels, enhancing space utilization many times over.

Pallet racking consists of a set of upright frames connected in various ways by horizontal beams to provide storage for palletized or non-palletized product depending on the rack configuration and beam supports used. There are five basic types of pallet rack:

Drive-In / Drive-Thru: This storage medium consists of a multi-level system of rails forming several levels of continuous pallet storage. It can be installed as either Drive-In, which is accessed for product delivery and retrieval from only one side (LIFO) Last-In First-Out, or Drive-Thru, which typically delivers product to one side and retrieves it from the opposite thereby preserving FIFO sequencing. This type of storage is used when storage density desired is high (potentially 85%) and SKU base is low. It is well suited for refrigerator or freezer environments where square footage costs are significantly higher which is why this type of pallet storage is often used in the grocery industry. Challenges include the following:

- Requires highly skilled fork lift drivers since they enter the rack system every time they deliver or retrieve product
- Quality pallets since they reside on rails that suspend them on each end
- Trapped product, no easy access to internal pallets

- System is designed for specific size pallets and can not be easily modified to accommodate larger or smaller width pallets
- Increased potential for injury and damage due to fork lift impact



Drive-in Racking
Drive-Through Racking

Fig. 2.1

Selective – Single or Double Deep: Single deep selective rack is the most common type of pallet racking in use and is one of the least costly types of basic storage. Think Home Depot, Lowes and Costco warehouses. Single deep offers access to every location giving users flexibility in product storage and retrieval, but it comes at a cost. Space utilization suffers and can only be regained through the use of higher lift technology to reduce aisle space. It is best used when 100% access is required or desired, large numbers of SKU's are handled relative to total storage, and access trumps cube utilization. Double deep selective rack allows for better space utilization and is no more costly per pallet location than single deep rack, but should only be used if storage density is more important than 100% access, since product can become trapped and require additional labor to maneuver. This type

of racking also requires specific lift equipment that can retrieve pallets from double deep locations.

Pallet Flow: This system consists of a rail or conveyor system installed in pallet rack that can be 20+ pallets deep. There are many versions of the flow mechanism, but the basic premise is to feed pallets in one end and pick them up on the other. Typically some sort of speed restrictor is installed in deeper systems to prevent impact damage. These systems provide the density and FIFO storage possible with Drive-Thru without the requirements to drive into the rack system. It is used when SKU count is low, FIFO is desired and square footage is tight. It is significantly more costly than Single Deep or Drive-Thru racking and requires use of quality pallets to prevent product from hanging up in deep locations.

Pushback: This is a system of carts installed into pallet rack. The carts are stacked and allow for storage of up to 6 pallets deep, although typically not used more than 4 pallets deep. Product is placed on a cart and then pushed back when the next pallet is placed in front of it. This is done until the final cart is pushed back and the last pallet is stored onto the rack beam. When a pallet is removed, the successive pallets move forward because the carts are installed on a slight decline toward the front beam. This system provides high storage density and is used when deep storage is desired near a wall or for medium turnover products with multiple pallets per SKU. Also, this storage medium is used when LIFO is an acceptable means to rotate inventory. Pushback racking is typically the most costly type of manual pallet storage.

Cantilever: A very specific type of racking used extensively in the furniture and lumber industry for long products that are better supported by arms instead of beam levels. Cantilever must be designed specifically for the products to be supported and may require special considerations based on the product size, weight, and rigidity.

Shelving,

Wide Span Shelving: Typically a lighter duty version of standard pallet rack, this shelving provides the same versatility, access and sizing as selective pallet rack when the overall capacity stored does not rise to light duty pallet rack standards. Not typically designed for pallet storage, this shelving is ideal for cartons, hand stacked storage, bin or tote storage, etc. Wide span shelving is common in loose pick, totes and small item storage. It can also be stacked to form shelf supported mezzanine structures that can maximize vertical storage.

Industrial Shelving: This type of storage offers multiple levels of storage or picking in a relatively small footprint. Shelves typically store anywhere from 300 – 1,000 lbs. per shelf level. Shelves can incorporate dividers, drawers, and many other accessories that augment the product stored. Used extensively in the automotive and electronics industries for small parts picking, industrial shelving is versatile and can be stacked to form multi-level mezzanine supports. It is less durable than pallet rack or wide span shelving, but is significantly less costly per storage location.

Carton Flow

The decision to use carton flow depends on many factors such as overall footprint available, consistency of product sizes and weights, SKU quantity, SKU velocity, and the list goes on. After weighing the pros and cons associated with using valuable space to set up a carton flow picking area, the next decision is to determine what type of carton flow should be used. The size, weight, and consistency of these variables will determine the best type of carton flow for the application. There is a great deal of difference in carton flow requirements for a warehouse that picks product from consistently sized and weighted boxes or containers and a warehouse where size and shape vary greatly. Even warehouse environmental conditions can play a deciding factor in what product to choose. For example, imagine the effects of high humidity on cardboard box's integrity. By placing a 40 lbs. cardboard box of widgets on 2 narrow rails of wheel track and letting it sit for a few days in the same spot in a humid warehouse, a set of nicely formed wheel ruts in the box appears. Consequently, the pickers will need to use that lovely sky hook to retrieve the stuck packages. Happens every day and there are ways to avoid this and other mistakes. There are a few basic types of carton flow and manufacturers typically provide different versions of them to set themselves apart, but for simplicity we will discuss the following basic categories: wheel track, full width roller, and skate wheel. Any of these types can be configured as either standalone units or rows, integrated into a new pick module or retrofit into an existing storage media.

Wheel Track: This type of carton flow typically consists of a frame or shelf assembly, wheel tracks or rails and dividers. The frame is welded, bolted or bracketed, the wheel tracks are

typically about 1” wide roll formed channels with integrated plastic wheels on roughly 2” centers. The wheels may or may not have axles. Dividers are most likely full length and adjustable.

- Pros:
 - Wheel tracks and dividers are adjustable so as your product mix changes you can modify the carton flow
 - Tracks and dividers can be replaced as they degrade or are damaged as they are not part of a composite unit
 - Shelves can integrate many types of accessories for product presentation, such as knuckle over trays
 - Shelves are not bound by the depth of the storage media allowing for ergonomic shelf positioning or excess depth where applicable
 - Additional tracks may be added to allow easier product travel
- Cons:
 - Wheels can bind or eventually cause friction that reduces product flow
 - Boxes may conform to wheels in high humidity environments depending on the product type, resulting in hang ups
 - Tracks can be difficult and time consuming to adjust once installed, especially when some presentation accessories are also present
 - Adding additional tracks to allow smoother product conveyance quickly adds incremental cost to each pick lane
 - This media is somewhat width limited since the entire assembly must be supported by the shelf or frame the

tracks are attached to. 96” wide shelves are typical, but sizes approaching 144” can be a challenge especially with heavier products.

- A small amount of pick able space is lost both in both depth and width due to the use of a shelf structure for primary support

Full Width Roller: This type of carton flow typically consists of gravity roller conveyor tracks of varying widths, roller centers and capacities. As with wheel track, it relies on pallet rack or standalone supports to provide the structural support, but typically uses standard pallet rack beams as the primary means for installation. Tracks can either be confined to the depth of the racking using rack beams as end stops or mounting areas for accessories, or attach on top of the beams allowing for more depth, ergo and accessory options. Some require brackets that allow the track to be attached to the beam and others simply lay in place and are secured as is. Deep lane applications may require additional beams for support above and beyond the in feed and discharge zones, although this is typically accomplished through the use of intermediated beams within the normal pallet rack structure. Some manufacturers may also provide a shelf or frame that allows accessories to be installed and depth adjustment beyond beam supports.

- Pros:
 - Full width rollers provide more surface area contact and may provide better conveyance for products with flimsy bottoms or in high humidity environments

- Width is only confined by the total bay width and beam capacities if no support shelf or frame is used. No loss of pick able space
- Roller centers and track widths can be modified to strike a balance between cost and functionality. Some product overhang is allowable.
- Tracks are easy to install as new product or in a retrofit. Typically involves in feed and discharge brackets and a lay in section of conveyor for rack beam installation.
- Cons:
 - Specific widths mean you are limited in the size product you can accommodate if business changes. They may be too large or too small as things change.
 - Cost is typically higher per bay than wheel track applications.
 - No ability for width adjustment once installed. Tracks are fixed width so new product is required if changes are desired.

Skate wheel: This type of carton flow blends the concepts of both full width roller and wheel track into a fixed width bed of skate wheel. Beds can be inserted to cover the entire bay width so the no gaps are present. Lane entry guides or full length dividers are used to separate lanes. Wheels can be aligned or staggered depending on the manufacturer and are typically much larger than those on wheel track rails. Wheels ride on an axle and are held in place in various ways.

- Pros:
 - Since the entire bay is one big carton flow section, there is no loss of pick able space.

- Lane entry guides are adjustable giving a breadth of adjustments for product size or changes.
- Number of wheels per foot can typically be adjusted by changing axle centers to mitigate cost if possible.
- Larger wheels provide a low coefficient of friction and are more aligned with full width roller surface area contact, mitigating the possibility of boxes forming around the wheel in high humidity.
- Easy to install. More aligned with full width roller install.
- Cons:
 - Typically higher cost due to full bay coverage, number of wheels and larger axle sizes than other options.
 - Entry guides may allow product to skew during transit if they are not full length.

Depth is usually limited to beam to beam depth of pallet rack unless standalone units or shelf frames are used.

Activity

1. What are the Classification of Storehouse?
2. Describe in detail Storage System and Methods with pros and cons?

CHAPTER THREE

STOCK RECEIPT AND INSPECTION

3.1. Meaning and Nature of Stock Receipt

Stocks and fixed assets may be received in storehouses from outside suppliers, donors and from user departments within the organization. Stocks must be properly looked after when they arrive. The problem of quantity shortage, damaged materials, incorrect items shipped, is detected during receiving.

The amount of documentation and inspection depends greatly on the nature of the item. It is desirable to avoid a lot of paper work, if this can be done without the risk of mistake in receiving the goods. Similarly, the extent of physical examination, weighing, counting, etc. of goods received should be arranged in the most economical way to avoid unnecessary delay or expense. If store houses are not open for all hours of the working days, it is advisable to inform the days and times during which facilities will be available to accept deliveries.

The responsibilities of the store keeper involve the receipt and proper inspection of materials received from all sources. The Procurement Officer is responsible for ensuring that materials accepted by the store house satisfy the ordering specifications given on the Local or Foreign Purchases Orders.

3.2. Types of Stock Receipt

As a general rule before receiving a stock or fixed asset and put to use from whatever source ensure the following.

- Make sure that proper authority authorize preferably in writing the receipt of the item.
- Assign a particular place for receiving the stock or the fixed asset that is typically the store house and sometimes the uses departments.
- Do not put to use the stock or fixed asset before the receiving procedure is fully completed.

i. Receiving From Outside Supplier

A typical receiving procedure from outside supplier consists of four steps:

1. ***Unloading and checking the shipment:*** - packed stocks are checked for external damage.
2. ***Unpacking and inspecting the stock:*** - The store keeper checks the material received against the packing slip and against the copy of purchase order to verify whether the correct items are received. For items that cannot be inspected by the store keeper because of its technical nature, they shall be inspected by the user or by authorized representative of the user department. For highly sophisticated items that need laboratory test, the procurement officer is responsible to carry out the test and inspection. This kind of testing and inspection can be undertaken in the

supplier's works or in other facilities outside the organization.

3. ***Completion of the receipt for articles or property:*** - After inspection and satisfaction that the materials are in good condition and as per specification the inspector shall prepare note for acceptance and are in good condition and fit for use. Only the materials which shall be accepted by the inspection are to be received into the store by issuing model 19(receipt for articles or property received). The model acts as evidence for the receipt of materials into the store. Model 19 shall be prepared in four copies and distributed as follows.
 - a. The original shall be attached to the supplier's invoice and shall be sent to the Accounts Unit to support payment
 - b. The duplicate copy shall be given to the stock clerk to register store movement
 - c. The triplicate to the supplier/ deliverer as evidence of receipt of the good
 - d. The fourth copy is the book copy for the storekeeper's reference

4. ***Delivery of the material:*** - for non-stock materials, such as fixed assets and materials acquired for a specific purpose, the store keeper is responsible for delivery of the material to the user department after completing the issuing procedures.

ii. **Materials Return To Store**

From time to time stocks may move from one store to another or from user departments to stores. There is no need for quality inspection for internal movement of goods. For new supplies that are returned to store from user departments the store keeper will prepare model 19. The distribution will be the same as stated above, except that the copy for finance and accounts will be retained with the pad. Since payment will not be effected. Fixed assets return to store will follow GOFAMM.

3.3. Stock Receipt cycle

The receiving section is central place where all incoming supplies are received, checked and inspected before storage or use. It is also called the Goods Inward Section. The functions of the receiving section are:

- ✓ Receive incoming materials,
- ✓ Check materials received,
- ✓ Arrange for Inspection,
- ✓ Raise Goods Inward Notes,
- ✓ Notify indenters of special purchase requisitions regarding the arrival of materials,
- ✓ Inform Purchase Section regarding excess supply, shortage or defective supply,
- ✓ Deliver materials to the appropriate stores for storage.

The stock receipt cycle in most of the stores operation may start when the stores section conducts a stock taking or

counting the status of the stocks. That means the store section conducts stock counting and control annually or semi annually to make sure that the required stocks are available in the store with the required type and quantity. Therefore, verification about which stock is available and which is not takes place in the first place. Second, after identifying the materials to be replenished, the stores section will prepare and send a purchase requisition to the purchasing section. The requisition may also come from the user department after they are checked for availability in the stores.

Then the requisitions which arrived from the stores or user department to the purchasing section will be processed for purchase and the purchase order (PO) copy will be sent to the stores section for the purpose of the items when they are delivered by the supplier. Therefore, this copy will help the stores section to check whether the delivered items conforms the requirement and are according the purchase order of the organization.

Receiving section receives a copy of the purchase order. This gives an idea of the goods to be expected and the storage arrangements to be made. The stores to which the materials are to be sent are also generally indicated on the receiving section copy of the purchase order. The receiving activity will then take place when the goods are delivered to the organization by the receiving section against the documents meant for receiving the materials. These documents may be the Materials Requisition (MR), Materials Dispatch and Receipt Report (MDRR), or simply the Purchase order copy (PO).

After these activities, then remaining are checking the materials received, arrange for inspection, prepare Goods Received Note (GRN), informing the responsible party (user and purchasing departments) regarding the arrival of the materials, deliver the stocks to their appropriate stores, and finally controlling the stocks about their issues and receipts so as to make a continuous control. This can be done through registering every incoming and issues made from the stores.

3.4. Materials Rejected Return Procedure

Stocks and fixed assets which are rejected by the inspector for whatever reason must be returned to the supplier immediately and be accompanied by the Damage/Shortage Report. The DSR is evidence that materials have been returned by the public body to the supplier. The store keeper shall raise DSR in 4 copies and shall be distributed as follows:

- a. The original shall accompany the stock or fixed asset being returned to the supplier
- b. The duplicate copy shall be sent to the Accounts/finance unit
- c. The triplicate copy shall be sent to the Procurement Officer
- d. The forth copy is a book copy for reference purposes by the store keeper

Here under you are provided with a form prepared by Public procurement agency for the rejected materials.

MINISTRY OF FINANCE & ECONOMIC DEVELOPMENT
DAMAGE/SHORTAGE REPORT

To _____ Date _____

With reference to the goods listed below, the goods are damaged/shortage/overage/not the right quality.

S. No.	Description of the Item	Quality Advised	D

Name and signature of the store keeper

Name _____ Signature _____

3.5. INSPECTION

Inspection is the procedure associated with the receipt of goods and their placement in storage is a check for quality. The increased concern for quality emphasized more on 100% inspection. But inspection has also costs like destructive testing. So balance is needed when inspection takes place. Depending on the number and type of commodities, inspection can be undertaken by:

- a. Storekeepers, when item is few in number and simple in its complexity

- b. Technical staff from users department
- c. Inspection department if it exists in the public bodies
- d. Inspection at supplier's work or at the premises of public body by independent inspectors

Whoever performs the inspection, the examination of the goods is for quality to ensure items are fit for use. The inspector should be provided the copy of the purchase order and relevant specification and samples to perform the task of inspection. To check quality, follow the following steps.

- a. Check the purchase order, the packing slip against the stock or fixed asset
- b. Obtain the material specification and test the stock or fixed asset against the specification
- c. Count, measure and check the quantity of stock and fixed asset against the purchase order and the packing slip
- d. Fill the Damage/Shortage Report for any discrepancy

Activity

- 1. What is stock receipt?
- 2. Explain and elaborate types of stock receipt
- 3. What is stock inspection?
- 4. Explain types of stock inspection?

CHAPTER FOUR

IDENTIFICATION OF MATERIALS

4.1. Stock Identification

The normal way of identifying an article is by simple description, but this by itself is not satisfactory for the stock purpose. Several different names may be used for the same thing, for example a dust bin, refuse container or rubbish receptacle. Again in order to identify some article accurately a very long complicated description is required. Take for example paper used as stationery; there are many kinds of papers, to identify only one of them properly, it is necessary to say that it is typing paper with specific size and color. Therefore, it is necessary to have some logical basis of identification which is more precise and less cumbersome. This can be done first by classifying the stock and assigning a code for each specific stock item.

Classification means systematic arrangement in groups or categories of stocks according to end use. The important principles of stock classification are the like should be

associated with the like; simplicity and ease of understanding of the stocks should be given paramount consideration.

4.2. Coding of Materials

Codification of materials can also be termed as the identification of materials. This deals with uniquely identifying each item in the inventory. It is useful in requisitioning items or the operational departments, in placing of orders by the purchase department, in receiving and expediting the items on receipt from the supplier, in having a unique record of each of the items in stores and in work-in-process or in warehouse so as to facilitate the control over the inventory levels, and also in having a good control over the loss, deterioration, obsolescence, non-movement, or pilferage of the items in the inventory. Unique identification of the materials whether they are raw materials, work-in-process or finished goods – is the first step towards a good materials management system. Without it, the control over inventory by rigorous exercises such as inventory techniques is not very effective. Without it, confusion might prevail in the operational departments. Moreover for a good quality control system a unique identification is a pre-requisite. There are many other advantages such as variety reduction and standardization etc.

A code is a system of symbols or numbers or a combination of symbols and numbers used for representing data for purposes of communication or for storage or for processing information. Each type of stock should be given number or letter or a combination of numbers and letters, which prevent

it from being mixed with other types of stocks. Some of the requirements for stocks coding are the following:

- a. One stock type should not be mistaken for another
- b. The coding should preferably tell the type of stock
- c. The coding system should be simple and easy to understand
- d. The coding system should be flexible and able to take any reasonable increase in the number of stocks

Therefore, the main objectives of codification are:

- a. To classify the items on functional basis so that one item is kept under one code.
- b. To bring together the items according to their degree of similarity so as to reveal and suggest suitable substitutes available.
- c. To prepare a catalogue indicating complete details for procurements action.
- d. To make available the catalogue to indenters to enable them to requisition an item.

4.3. Importance of Coding

It is amazing to find that in many of our large public and private sector corporations, a considerable amount of inventory lies in the stores or elsewhere because of a confused nomenclature and a lack of proper identification system. Many items in inventory such as pipes, rods, angles, electrical switches, cables, valves, similar equipments, spare parts and even nuts, bolts and such items in inventory are available

under different names and codes thereby reducing the actual availability of the item for operational needs. An item may be called a 'nut and bolt' by one section of the organization, whereas another may call it a 'fastener' and because of this there are two separate requisitions made, two separate purchase orders sent out, and two separate inventory levels of the items built into the system. One section might call an item a 'pipe' whereas another might call it a 'conduit' in fact both sections using the same item. This increases the inventory level unnecessarily. Prevention of duplication is one of the important benefits of a good materials coding system.

Needless to say, for proper stock taking a good identification is of immense help. Many cases have been observed in large corporations where the concerned people do not even know what materials have been laying in the inventory for a large duration of time. These materials could easily be eliminated from the list, salvage value recovered and the storage space freed. It is also not uncommon to observe that although a material is available with the stores in reality due to duplication of the identity it is often quoted as 'not available' and thus, many production programs suffer with consequent loss to the organization as a whole. Proper identification of inventory items helps in simplification of all the processes such as storing, receiving, procuring, manufacturing, warehousing and this results in a multiplicity of benefits to the company. It is a simple concept. If followed it might produce results of proportions equivalent to that of a rigorous application of the inventory control principles with, perhaps much less effort.

Classification and coding are necessary for the following reasons.

- a. To avoid repeated use of long descriptions in all stores documents which entail more clerical labor and confusion,
- b. Accurate identification of all stock items
- c. Prevention of duplication, since similar items will be group together and once an item is coded should not be given any alternative code number
- d. Codes assist in standardization, which is the most important use of stock code. Standardization of stock is the process of reducing the number of varieties stocked, to a controlled workable minimum. The classification of like items makes it easy to examine the complete range of any given type of stock and consider whether the number of varieties held can be reduced and standardized. A simple example of this process is the standardization of paper. Paper of different sizes and weights (A-4, A-3 80gram,70 gram) and paper of different color (white, blue ,pink and yellow), still paper for different use (typing, duplicating, and photocopying). When all different types and sizes of paper have been coded and listed, the list can be examined to see whether the range is too detail or not. An examination of the uses served by the paper could result in standardization on one or two types only. Such standardization improves the management of stock and procurement. Product standardization can be a powerful stock management tool when it is used to reduce duplicate and redundant

items in stock and aggregate the demand of seldom purchased products. The reasons for standardization may include reducing costs, simplifying supply support efforts, or improving quality. Without standardization, there is little to prevent random purchasing and supply decisions

- e. It serves as storehouse location and allocates the storage space
- f. It provides as a base for sorting stock documents like receipts and issues
- g. Coding simplifies computerization and data processing
- h. The classification/code system can be used as a means of physical control for location and storage of stocks.

4.4. Code Symbol

What do we mean by coding? By this, we give a unique number to a particular item in the inventory. For instance, 010237 might mean a specific item in inventory such as a particular kind of gasket, of a certain material, of a certain shape, and of certain dimensions. Of course, each of these numbers or groups of numbers (within the total identification number) should convey some unique information. For instance, the following numbers might be used to describe the first classification of materials in an inventory:

- 01 – Raw materials
- 02 – Purchased components
- 03 – Spare parts

- 04 – Tools
- 05 – Fixtures and Patterns
- 06 – Other supplies
- 07 – Work-in-process material
- 08 – Finished goods
- 09 – Capital Equipment

The next classification group may be based on, say, ‘shape’ of the items. For instance:

- 1... Wire 4... Bar
- 2 ...Tubing 5 ... Sheet
- 3... Rod 6... Strip

Further classification could be based on the material of construction. For instance:

- 01... Mild Steel
- 02 ... Stainless Steel – 304
- 03 ... Stainless Steel – 316
- 04 ... Stainless Steel — ...
- 05 ... Stainless Steel — ...
- 06 ... Copper
- 07 ... Brass
- 08 ... Bronze
- 09 ... Aluminum
- 10 ... Special alloy
- 11 ... PVC
- 12 ... Polypropylene

To this, one may add further classifications in terms of the composition, use, characteristics, etc. For instance, for metals we could have a group of classification as follows:

- 01 ... Cold rolled,
- 02 ... Tempered
- 03 ... Normalized
- 04 ... Annealed,
- 05 ... Hardened etc

If the material is a wire, then the next group of classification could be in terms of the ‘use’ characteristics such as:

- 01 ... 5 amps
- 02 ... 15 amps
- 03 ... 25 amps

Thus, an item could be coded as: 08 1 06 03 01 this nine digit code uniquely identifies the item as a ‘Finished’ Product, Wire made of copper, Normalized for 5 amps performance.

Codification as done above is called Codification by group classification where the identification is done by reserving a number of characters (spaces) for each ‘group’ of classification. In each group the relevant ‘details are sequentially numbered.

For example, if you take in Ethiopian case, the government agencies are required to code and identify materials as follows which is established by the Ministry of Finance and Economic Development.

Manual III of the EFG accounting system, volume II EFG chart of accounts classify supplies and materials as follows.

Following this classification each public body is expected to comply and categorize its stock.

<i>Figure 1</i> Classification	Code
Uniform, clothing bedding	4401
Office Supplies	4402
Printing	4403
Medical Supplies	4404
Educational Supplies	4405
Food Items	4406
Fuel and Lubricants	4407
Other materials and articles	4408
Agricultural, forestry, and marine input	4409
Veterinary supplies and drug	4410
Research and development supplies	4411
Ammunition and explosives	4412
Building and construction materials	4413
Spare parts	4414
Raw materials stocks	4415
Work in progress stocks	4416
Finished goods stocks	4417
Other materials and supplies	4418

There are three levels of classification for the stock of materials and supplies of public bodies. The first one will be

the major classification as indicated in figure 1. The second one is the sub classification under the major classification. The third classification is identifying the specific item within the sub classifications.

Let us illustrate this with example. Suppose we consider office supplies as major classification, there are many items in this classification to be sub classified as stationery supplies. Consequently, we may further group the stationery items and identify the individual item. Say A-4 size photocopies paper, which is the specific item.

The code system for public bodies assigns ten digit code numbers to each specific item. Working from the left to right each digit places the item in a successively narrower class until further differentiation is not required. The first four digits are used for the major stock types. The next three numbers indicate the sub class and the last three numbers indicate the specific item. The following example illustrates the concept.

The code given for a stock item is 4402- 001- 001. The first four digits indicate the item is office supplies, the next three digits i.e., 001 indicate the sub class within the office supplies let us consider this as stationery supplies. The last three digits indicate the specific item within the sub class stationery supplies; let us designate it as white A-4 size photocopy paper.

4.4. Method of codification

One can adopt different methods of codification. They are:

- a. Alphabetic Code
- b. Numerical Code
- c. Combined Alphabetic and Numerical Code
- d. Brisch coding system

A. Alphabetic Code

Under this system, ‘alphabets’ become the basis and codes are allotted to each item in alphabetic order. Each item is grouped according to its nature, use, etc. and the first alphabet of the name of the materials is the starting point of codification. Subsequent sub-alphabets are used depending up on other characteristics of the material in question. The following illustration shows how the system works.

Class	Group	Code
Raw Materials:		
Iron	Bars, Ms	IR-BA-MS
	Bright Steel	IR-BA-BS
	Melted	IR-MEL
	Mould	IR-MLD
	ORE	IR-OR
	Pig	IR-PG
	Sheets, MS	IR-SH-MS
	Sheets,	IR-SH-BS

However, it is not always easy to remember the codes and there are chances of duplication. Coding mistakes are frequent due to repetition of alphabets in the same code. It is only suitable where the number of items at desired level is limited.

B. Numeric Code

Against the alphabetical system, the numerical system is based on numbers; simple numbers, block numbers or dash/stroke numbers. For example:

Materials	Simple Number	Block Number	Dash or Stroke Number
Raw Materials	1	1 - 1000	15 15-1 or
Iron Ore	5	1 - 10	15/1 15-2 or
Pig Iron	6	11 - 20	15/2 15-3 or
Melted Iron	7	21 - 30	15/3 15-4 or
Bright Iron	8	31 - 40	15/4 15-5 or
Steel Iron	9	41 - 50	15/5 15-6 or
Iron Sheets	10	51 - 60	15/6

			15-7 or
Iron Bars	11	61 - 70	15/7
			15-8 or
Iron Mould	12	71 - 80	15/8

Simple Number: One number is allotted against each material, with some other number being kept as provision of other items.

Block Number: The numbers are so designed that materials of similar nature or group come under one block. As for example, raw materials block comes under 1 – 1000, consumable oil and lubricant materials block comes under 1001 – 2000, packaging materials block comes under 2001 – 3000, jigs, tools and fixture materials block comes under 3001 – 4000 and so on. Again, raw material block may be sub-divided into small blocks according to the category of materials, as for example, iron steel, and allied group, copper, nickel, alloy, tec. 1 – 100, 101 – 200, 201 – 300, 301 – 400, 401 – 500, respectively.

Dash/Stroke Number: a further improvement over the block numbering is ‘dash/stroke’ numbering system. A dash or stroke is put against the main element of the material in order to code the material in the same group.

C. Combined Alphabetic and Numerical Code

This system, as the name suggests is the combination of both the Alphabetical and the Numerical System described before. In order to improve upon the alphabetical system, and also take advantage of the numerical system, this system allows

alphabets to be retained to a limited extent and then uses the number codes. The materials are first grouped under some main classes and then sub-grouped under the numbering system. The following illustration will make the system clear.

Main Class (Broad Particular Class distinction)	Sub- group I	Sub- group II	Code
1. Carbon	CB		
Carbonic Acid		11	CB - 11
Carbon			
Monoxide		12	CB - 12
Carbon Dioxide		13	CB - 13
2. Manganese	MN		
Manganese			
Acetate		21	MN - 21
Manganese			
Dioxide		22	MN - 22
Manganese			
Oxalate		23	MN - 23
3. Phosphorous	PH		
Phosphoric			
Acid		51	PH - 51
Phosphorous Pentoxide		52	PH - 52
Phosphorous Trioxide		53	PH - 53
4. Sulphur	SP		
Sulphurous			
Acid		81	SP - 81
Sulphuric Acid		82	SP - 82
Sulphur Oxide		83	SP - 83

D. Brisch Coding Systems

This system is similar to the numerical system described above. Noted for its comprehensive nature, it lends itself to easy adoption. A 7-digit numerical code is assigned to each item with digital significance by virtue of their position and value. It works in three phases:

- a. The materials are grouped into suitable categories, as for example,
 - i. Primary materials,
 - ii. Shelf-items (purchased)
 - iii. Components (according to company's own design),
 - iv. Assemblies and sub-assemblies,
 - v. Tools, jigs and fixtures, etc.
- b. After preliminary identification and grouping, materials are further sub-divided according to their class characteristics as under decimal system.
- c. Then by establishing differences at various levels of classification, they are again sub-divided at a still lower classification level.

The main objective is to describe the material in greater details with less use of numbers, which permits accurate and unambiguous identification. The 7-digit code is not rigid, it may be varied as per requirement.

Merits and Demerits of Codification

As already noted, a rationalized system of codification not only helps accurate identification, prevent duplication and reduce varieties, but also helps mechanical recording, accounting, pricing and costing of materials. Locating and indexing for inspection are also made easier. But while, codification is beneficial, it should not be supposed that it does not suffer from demerits. The main demerits are that often codes are misunderstood and, when there is a mistake, finding out the exact code is rendered difficult. Moreover, when large numbers are coded in one group, this leads to confusion.

4.5. Procedures for developing coding system

The procedures to develop the system of identification include the following.

- a. Visit all store houses and stock records so that their current system for identification of stock is inspected, and record in full the system of identification of stock. List all the stock items and if available their yearly consumption. This can be easily obtained from the bin cards or other stock documents. Emphasis is only on stock item
- b. Classify all the items on major following the classifications as given in figure 1 of this part. Assign the four digit number code for each major classification.
- c. Reclassify each classification in to sub classes. For example uniform further be classify into uniform, clothing and bedding. The sub class is assigned three

digits from 001 to 999. There is no hard and fast rule for regrouping of each item. The important thing to consider is the number of line items used by each public body. It is also important to know that the degree of detail in sub classification depends on the benefit you obtain from the information. If it is too detail it can only understood by experts and leads to confusion.

- d. Reclassify each classification in to sub classes. For example uniform further be assigned three digit number from 001-009 to the specific item.
- e. Consult the procurement unit, the accounts/finance unit and the users departments to get their agreement.
- f. Once you get the agreement, complete the stock code and distribute copies to the units really have need of it.
- g. Amendments are published at least yearly, in accordance with the original distribution. Changes are not made in classifications unless there is a change in FGE chart of accounts.
- h. Visit all store houses and stock records so that their current system for identification of stock is inspected, and record in full the system of identification of stock. List all the stock items and if available their yearly consumption. This can be easily obtained from the bin cards or other stock documents. Emphasis is only on stock item
- i. Classify all the items on major following the classifications as given in figure 1 of this part. Assign

the four digit number code for each major classification.

- j. Reclassify each classification in to sub classes. For example uniform further be classify into uniform, clothing and bedding. The sub class is assigned three digits from 001 to 999. There is no hard and fast rule for regrouping of each item. The important thing to consider is the number of line items used by each public body. It is also important to know that the degree of detail in sub classification depends on the benefit you obtain from the information. If it is too detail it can only understood by experts and leads to confusion.
- k. Reclassify each classification in to sub classes. For example uniform further be assigned three digit number from 001-009 to the specific item.
- l. Consult the procurement unit, the accounts/finance unit and the users departments to get their agreement.
- m. Once you get the agreement, complete the stock code and distribute copies to the units really have need of it.
- n. Amendments are published at least yearly, in accordance with the original distribution. Changes are not made in classifications unless there is a change in FGE chart of accounts.

Please note that it may not be advisable to include every item of stock. Stock Items which are seldom required are bought and used straight away and other items of non- repetitive nature should be avoided from the code.

Activity

1. Explain the importance of codification.
2. Mention down types of codifications.
3. Mention and discuss storage system and methods
4. What are the common documents and records in store?

CHAPTER FIVE

ISSUE AND DISPATCH OF STOCKS

5.1. Issue of Stocks

The term “issue” here means supply of materials from stores to the various workshops or departments of an organization. Generally, tools are issued to workmen at the stores counter. Materials such as cotton waste, emery paper, soap, etc., are collected from the stores either by workmen or by progress men. Raw materials and finished components are delivered to the work point either by the progress department or stores. This is the usual practice, which, however, can be modified to suit local convenience.

For the purpose of issue, items may be divided into two categories: (1) items issued on requisition for direct use and (2) items issued on loan and scrapped in due course.

Service given by storehouse to users department becomes effective at the point where the store keeper issue stocks. Issue can be divided into issue to user departments/units and issue to outside branch stores and consumers. Stock represents money, in order to avoid misappropriation or waste procedure should be laid.

The usual method of issue is by a Material Indent Form, or Materials Requisition, which has to be signed by the indenter. If a material has been issued on a verbal instruction because of an emergency, then it has to be followed by a written document without delay. This should, however, be allowed

only in exceptional cases. The responsibility to indent for material should be specifically delegated to officers.

From scheduling point of view, issues are made:

- a. ***Only items taken on ledger charge shall be issued.***
- b. ***On imprest basis:*** - this is issuing stock, at the end of given period, say a week or a month. The user concerned prepares a list of materials consumed during that given period of time and presents stores requisitions. This type of issue is appropriate for stationery supplies.
- c. ***Replacement issue:*** - for certain items like vehicle tires and tools, users are required to present used article to the storekeeper before a new one can be issued.
- d. ***For non-stock items like fixed assets, goods are issued and delivered upon receipt by the storekeeper***

5.1.1. Type of Issues

Issue can be divided into issue to user departments/units based on requisition and issue to outside branch stores and consumers. In this chapter we shall deal with the items issued on requisition.

a. Issue on Requisition

A requisition is a written authority for the Stores to issue materials to any person or section of the organization entitled to draw materials from the Stores. No issue shall be made from the stores without a proper requisition.

This issue is made to the user departments when a request for production materials for general purpose is arrived to the stores. These materials may be raw materials, components for assembly, spare parts for repairs, work clothing, equipment spares, general stores and stationary, capital equipment, tools and testing instruments, pattern and core boxes, electrical instruments, and the likes.

The requisition should have columns for class and code numbers, description, quantity required, quantity issued, date of issue; works order number, requisition number, signature of the authorizing person, signature of the issuing store-keeper, and signature of the receiver of the materials. A requisition shall be valid for drawing materials only against one works order and from only one store. The number of copies in use varies from organization to organization, but generally copies are provided for accounts, Stores, and the department drawing the material. All requisitions must be posted on the Bin Cards and at least by the following day on the stock control cards.

Basically there, are three types of requisition Single items requisition, Multi item requisition, and Pre-itemized group requisition. However, they may be titled “General Stores Requisition”, “Group requisition for milling machine components”, “Stationery requisition”, “Work Clothing Requisition”, “Tool Replacement requisition”, etc., to indicate the purpose for which the forms are used although a requisition just titled “Material Requisition” may be adequate in most cases.

b. Issue to outside branch stores and consumers

In a large industrial unit, there, may be number of warehouses scattered over a large area at different locations. The warehouse staffs are often under tremendous pressure to meet frequent and unscheduled request for issue of materials, more so when the material requisitions are made at the same time from different warehouses.

And also if the store is a wholesale store or retail store an issue can be done based on the request of the customers. In this case the store is business making stores established for business.

The following considerations should be noted when issuing materials or stock items. These important considerations regarding issuance of materials are:

- Materials should be issued under proper authorization.
- Materials should be issued authorized person only.
- Items to be issued as per the requirements of the user should be identified correctly.
- Quantity issued should be correct as per issue note. It should neither be less nor more.
- Documentation relating to the issue of materials should be complete indicating all the necessary information needed.

5.1.2. Procedures for Issue of Stock Items

Issue procedures and documentation should be so designed as to enable the user to get the materials without any delay and with minimum effort. The records and documentations should enable proper cost computation, cost control, and management reporting. Store records should be able to provide up-to-date stock level of all items at all times, and the stock level in the record should tally with the physical stock balance of the items. This will provide the desired safety for the items and help in avoiding any pilferage and theft.

The procedure for stock issue for users departments involves the following three steps.

- 1. Approval of Requisitions:** Before stocks can be issued there must be proper authorization. Store keepers should keep full details of the names, title and specimen signature of all persons delegated to approve issue notes in a separate file. For some materials, it might be necessary to restrict issuance to certain levels of management, e.g., use of drugs, chemicals or explosives must be restricted to authorized individuals.
- 2. Processing of Requisitions:** As stocks are needed they should be requisitioned by the users department using Model 20. The aim of raising a Stores Requisition is to authorize issue of stocks. The stores requisition is prepared by users department in single. This form should be forwarded to PAO for approval. Stocks of any type should only be issued to persons who produce properly raised Stores Requisitions. Following the receipt of the store requisition, the

storekeeper prepares the issue sheet and pick and handover the stock requested. The store keeper prepares model 22 in 3 copies to be distributed as follows.

- a. The original shall be attached to the Stores Requisition and sent to the stock clerk for posting the issue in stock records
- b. The duplicate copy shall be sent to the department/unit that requisitioned for the stocks
- c. The triplicate copy shall be retained in the pad by the storekeeper for reference.

3. Receipts by user Department of Materials and Supplies Requisitioned: When delivery is made, all items should be counted and inspected by the ordering department. Assurance should be made that the articles requisitioned are being delivered in the quantities requisitioned and approved by the PAO.

5.1.3. Issue Documents

The main forms that shall be used are:

- a. **Stores Requisition (Model 20)**
- b. **Gate Pass (GP) –** This is discussed and indicated under the material dispatch and the form is also indicated under the same section. But the following table indicates the form for material requisition.

Works Order

No. _____

No. _____

Department _____

Date _____

Store _____

Class	Code No.	Description	Qty. Required	Qty. Issued	Bin. Bal.
Authorized by		Issued by	Received by		
Posted ob Bin Card by		Posted ob Stock Card by		Account Section	

**Copy to: Accounts
 Inventor
 Stock Control**

Table: 5.1. Material Requisition Form

A responsibility on the function of issue of stock rests on the following three bodies.

- a. The PAO has the overall responsibility for ensuring that stocks issuing procedures are adhered to
- b. Heads of departments/units are responsible for ensuring that all issues of stocks to their departments are made in accordance with their requirements and that such stores are put in good use only for the official purpose of the public body
- c. Storekeepers are responsible for ensuring that stocks are issued to authorized persons only who bring to the store properly completed Stores Requisitions.

5.2. Dispatch of Stocks

5.2.1. Stock Dispatch Procedure

Stocks are dispatched outside the organization for various reasons. For some public bodies goods are sent to branch offices; sales of scrap and used items to outsiders; and finished goods are sent to customers. The following procedure is recommended in dispatching goods.

A. Analyze order to identify work requirements

1. Order request and consignment note documentation is interpreted.
2. Required schedules for dispatch are identified.
3. Product/s in order is/are identified.
4. Workplace and product knowledge is used to plan sequence of work.
5. Appropriate materials handling equipment is selected within required OHS regulations and timeframe for the dispatch.

B. Follow workplace order picking processes to prepare goods for dispatch

1. Goods for dispatch are selected, checking against product knowledge, labels and other identification systems.
2. Products are sorted, assembled and consolidated.
3. Orders are secured and placed in storage/dispatch zones, in accordance with schedule.
4. Order is checked against dispatch schedule and order form.

C. Complete dispatch following workplace procedures and schedules

1. Workplace records are completed, and labels and appropriate documentation attached.
2. Load labels and documentation are checked and loading is organized in accordance with workplace procedures and Australian Dangerous Goods (ADG) code (where applicable).
3. Final check of load labels and documentation is completed in accordance with requirements.
4. Transportation requirements are described to driver where appropriate.

5.2.2. Documents used in Dispatch

To ACCOUNTS Department Name & Address of Consignee Description of Materials References:	Ref: _____ Date _____ A O No. _____ D N No. _____ Letter _____
---	--

Details of Cases Dispatch:

Wagon/R. R. No.	Batch	Cases	Nos.
Station dispatched	from		to
Mode of dispatch		Freight	
Transport Charges		Misc. Charges	
Completed on		Demurrage	

Enclosures:

- (1) R/R No. _____
- (2) Delivery Note No. _____
- (3) Packing List _____
- (4) Shortage List _____

REMARKS

Fig.: 5.2. Material Dispatch Advice

The Gate Pass shall be prepared in 3 copies and shall be distributed as follows:

- a. The original to accompany the materials leaving the public body and given to the person who receive the stock to serve as reference of the material received.
- b. The duplicate copy shall be given to the Storekeeper
- c. The triplicate copy shall be given to the Security Officer/Security guard for record and reference

5.3. RETURN OF REJECTED MATERIALS

Rejections should be handled promptly and with good judgment. The responsibility for return of rejected materials lies with the Store Keeper and the Inspecting persons. When material rejection occurs, immediate action must be taken to return, replace and / or dispose of the rejections.

Decision to return, replace and / or dispose of the rejected materials is the sole Responsibility of Purchasing official.

Activity

1. List down types of stock issue.
2. Mention down stock issuing procedure.
3. Discuss the objective of dispatching stock.
4. Mention down the main documents used in dispatching a stock.
5. List down a series of procedures in dispatching a stock.

CHAPTER SIX

STOCKTAKING AND VERIFICATION

6.1. Stock Taking

One of the principles of the stores management and materials handling is careful handling and proper use of materials and properties. For implementing this principle, a system for stock taking and stock control is mandatory.

Stock taking is the work of finding out by stores staffs the physical balance or ground balance of the various items by means counting, weighing, measuring or estimating. Stock taking enables to know whether there are any discrepancies in the posting; whether any pilferage is taking place; and whether the materials are in good condition. It also helps the preparation of the final inventory for balance sheet purpose.

Generally therefore, stock taking is the complete process of physically counting, measuring or weighing the entire range of items in the stores and recording the results in a systematic manner. The purposes served by stock taking are as follows:

- a. To verify the accuracy of stock records
- b. To support the value of stock shown in the stores documents by physical verification
- c. To disclose the possibility of fraud, theft or loss

- d. To reveal any weaknesses in the system for the custody and control of stock

Stock control is the activity of determining the range and quantities of materials which should be stocked. It involves techniques of maintaining stock items at levels which give satisfactory service level while minimizing stockholding costs. The major objective of any stock control system is to assure that materials are on hand when they are needed. Specifically the objectives are:

- a. To determine when to replenish, by what quantities to replenish and to fix minimum and maximum levels for each stock item
- b. To identify damaged/obsolete stock items

The responsibilities under stock taking and control include the following.

- Makes proper preparations for stock-taking of all stocks of the public body.
- Issue —Stock-taking instructions which shall be followed by all members of the stock-taking team.
- Arrange for pre-stock taking training to ensure that stock-taking instructions are understood by all members of the stock-taking team.
- Ensure that all the storehouses and stock are neat, properly arranged and well labeled before, during and after the stock-taking exercise.

6.2. Kinds of Stock Taking

Stock taking is mainly of three kinds; Routine check, Periodical stock taking, and annual stock taking. However, there are two widely used methods of stocktaking: *periodic* and *continuous*.

A. Routine check

Continuous stock taking is the method where by stock is taken throughout the year in accordance with a predetermined program so that each item is physically verified at least once in the course of the year, or more frequently if required.

Routine check, as investigated here, is done by the storekeeper in charge of each store in order to ensure the accuracy of the stock of expensive and easily saleable articles like ball and roller bearings, precision instruments, drill bits, materials such as oils, timber, etc., which may be stored in the open; and any other items in respect of which discrepancies might occur if a close watch is not kept. Only two or three items are checked each day by the respective store keeper and the results are recorded in a register which is reviewed by the chief storekeeper.

B. Periodical stock taking

By the periodic stock taking method, the whole of the stock is covered at the same time at the end of the given period, usually the end of the fiscal year. Under such method the operation of the store should stop until stock taking is over.

Periodical stock taking is quarterly or half yearly checking of the entire stock in one or two days. This is in a fashion in place where the stock comprises a few but expensive items. The method followed is similar to the annual stock taking, i.e., physical stocks of various items is recorded on inventory sheets or inventory card and then compared with the bin card balance. While inexpensive items may be checked once a year, expensive and attractive items should be checked three or four times a year. The physical balance obtained at the end of the financial year will form the inventory for final accounts.

C. Annual stock taking

Where periodical stock taking by store staff or continuous stock verification by accounts staff is not in force, complete checking once a year is very desirable. Annual stock taking is done in the last month of the financial year. In certain places, the factory will be closed for a few days and in another places the receipt and issues will be suspended until the stock taking is over.

Circulars are also sent in advance to the suppliers not to deliver any materials during stock-taking days. Closing of the works, suspension of receipt and issues, etc., might be possible in small plants but would involve serious loss of production to a large organization.

Similarly, checking of a large number of items within a limited period of three or four days will be a rush jobs and may entail lack of concentration, misplacement of materials,

etc. A system of annual stock taking which does not involve the closing of the factory or suspension of issues and receipts is described below. Two weeks or a month may be taken for the checking, depending up on the number of items to be checked and persons available for the job. The theory behind this method is that if the bin card balance and physical balance agree on the day of the checking, they should generally tally on the last day of the financial year, and if there is any shortage or excess on the day of the checking, then the same shortage or excess should exist on the last day of the financial year. And the physical balance on the last day of the financial year is obtained not by counting the stock of all items on a single day but deducting the shortage from or adding the excess found during the course of the checking over three or four weeks, to the bin card balance on the last day of the financial year. This theory must be clearly understood in order to follow the system in detail. An example of the bin card entries is given below to illustrate this.

Receipt	Issues	Bin card Balance	Phys Bal
1 st December....50		50	
	6 th December 10	40	36
12 th December....6		46	
	18 th December.....20	26	
	25 th December.....5	21	
	31 st December....	21	17

Suppose the checking is done on 10th December and the bin card balance, physical balance and shortage are 40, 36, and 4 respectively, the physical balance as on 31st December when the bin card balance is 21 will be taken as 17. The surplus will also be treated in a similar manner.

6.3. Methods and Procedure of Stock taking and Verification

Stock taking can be done by using inventory sheets (Stock Verification sheets) or inventory cards (stock verification card). Generally inventory sheets are used for item-by-item method of checking and the inventory cards for bin-by-bin method of checking. Both the methods are described below.

A. Inventory Sheet Method

In order to prepare the annual inventory as on the last day of the financial year, say 31st December, physical check of all the items will be carried out between 1st December and 25th December. The period 25th December to 31st December will be utilized for final scrutiny of the discrepancies, by recounting where necessary, etc.

Checking will be done during working hours if time permits or after working hours. (If the strength of each store has been fixed according to the correct workload, it is very unlikely that the stock taking can be done during working hours without extra men).

The approximate number of items to be checked per day has to be worked out in advance. The chief storekeeper must ensure that the stock taking in each store is proceeding according to the target fixed for each day and for each week.

The inventory sheets with the name of store, class, code number and a short description of the materials will be prepared in three copies in advance. Separate inventory sheets will be prepared for each class and the items will be listed in numerical order. New items received after the preparation of the inventory sheets will be added to the last page of the respective class.

The first two copies will be kept for entering the final figures as on the last day of the financial year and for sending to Accounts and Stock Control. The third copy will be used for the rough work of recording the physical balance and bin card balance as on the day of checking, storing out discrepancies and correcting errors if any.

The checking will be done item by item as given on the inventory sheets. Also the items checked will be suitably marked or labeled to find out later whether any item has been excluded. If there are any such items they will be entered on separate inventory sheets and after the necessary investigation, bin cards will be created. (This generally happens only when the first stocks taking is done after the store has been set up).

After the checking on each day, the physical balance and the date of checking will be recorded in pencil on the bin card

against the last entry on the date and similarly the bin card balance will be recorded on the inventory sheets. The location number on the inventory sheets will also be compared with the location number on the bin card.

The posting of goods inward note (GIN), requisitions, etc., must be up to the date when comparing the physical balance and bin card balance lest there will be difference due to the pending postings.

Any difference in the physical and bin card balance and the location numbers will be scrutinized immediately. If an item has been binned in more than one place, a final recounting of the total quantity might be necessary to avoid incorrect balances.

If ultimate reconciliation among the physical balance, bin card balance and stock control balance is desired, the inventory sheets, after scrutiny, should be sent to Stock control on the following day. It may, however, be mentioned that reconciliation of differences between bin card and stock control balance is at times laborious but it ensures greater accuracy in the preparation of the final inventory sheets.

By 25th December, checking of all items should be completed and the next few days can be set apart from final scrutiny of discrepancies and re-counting items where necessary. Care must be taken to see that the stock of every item is checked.

By 31st December, the final list of shortages and excesses should be ready and after ensuring that all the posting up to

the evening of 31st December are completed, the discrepancies will be recorded against the last entry on the bin card.

The physical balance of the items in receipt of which there are discrepancies will be arrived at by adding the surplus to, and deducting the shortage from, the bin card balance as on 31st December. The physical balance of the remaining items will be the same as the bin card balance as on 31st December.

The bin card and physical balance as on 31st December will be recorded on the original and duplicate copies of the inventory sheets. The original will be then sent to Account Department, who will arrange for the same to be certified by the auditors after verification. The duplicate copy will be sent to stock control for recording the balance on the stock control cards.

The shortage will be written off and the excess will be brought on charge with the approval of the management.

The physical balance as on the last day of the financial year will be endorsed on the bin card as shown below by means of a rubber stamp. “PHYSICAL BALANCE AS ON 31.12.2010 – 1000 Nos.”

As soon as the closing stock is recorded on the bin card, posting of new receipts and issues can commence.

Stores _____

Class _____

Code No.	Description	Stock Control balance	Bin Card Balance	Physical Balance	Shortage
38-218	9/16 BSW Chase for 3/4 DH	4 Sets	4 Sets	3 Sets	1 Set
42-019	St. Shank Drill No.19 Taper Shank Drill 29/64" dia.	70	70	70	-
42-229	dia.	20	20	18	2
42-512	St. Shank Drill 3/16" dia. Wimet Tool No. 52 Grade	135	135	135	-
85-530	"N"	70	70	70	-

Table: 6.1. Stock Verification Sheet

B. Inventory Card Method

Inventory card or stock verification card is generally used for the bin by bin method of checking although it can as well be used for the item by item checking. The columns have been provided to show the date on which the checking has been done, the physical balance, initial of the person who checked the stock, bin card balance, location of the item, etc.

Every items or in another words, every bin card will have a corresponding inventory card. Normally this will be kept in class and code number order. Before checking, the cards will

be sorted out according to bin numbers, i.e., if the bins are numbered A, B, C, etc., and the pigeon holes, 1, 2, 3, 4, etc., the cards will be arranged in the order of A1, A2, A3, and so on.

The persons engaged in checking will be divided into groups of each. One will do the counting and the other will enter the physical quantity on the inventory card. To start with, one set of bins will be allotted to each group and when a group completes the bins another set of bins will be allotted to it. The process will continue until the materials in all the bins are checked.

If, during the course of checking, an item is found to have no inventory card, a new one will be prepared giving the class, code number, description, quantity found and location. Similarly, if an item cannot be identified, it will place separately on a table for consultation and necessary action after the day's checking is over.

At the end of each day's checking the physical balance shown on the inventory cards and the bin card balance will be compared. If both the balances agree the physical balance will be entered on the bin cards and the bin card balance on the inventory card.

Where the two balances do not tally, the inventory cards will be kept separate and the items will be rechecked.

If the discrepancies are confirmed, two lists, one for the short ages and the other for the excesses, will be prepared. The

shortages will be written off and the excess will be brought on charge with the approval of the management.

After checking all the bins, the inventory cards will be rearranged according to class and code number sequence.

Class _____ **Location** _____
Code No. _____
Description _____

Date	Stock Control Balance	Bin Card Balance	Physical Balance	Shortage	Excess	Rem Con

Table 6.2 Inventory Card

The procedures needed to conduct stock taking and verifications are discussed in detail in the following consecutive paragraphs. All stocks in storage shall be checked at least once within the he are: High value stocks, Dangerous stocks, Stock with great risk of pilferage and Stock with rapid usage.

The store keepers should not be members of the stock taking teams but they are required to know what they keep, guide the stock taking teams during counting and watch the security of stocks during the stock taking process. The stock taking teams

shall be given pre-stock taking training/seminar on how to record on the stock-taking papers, how to count, how to weigh, how to measure and how to identify the stocks.

Serially numbered stock taking sheets shall be prepared in advance. The stock shall be pre-typed on the sheets in logical order, usually in the same order as they are stored on the shelves and records in the stock records. The management shall establish date of stock taking, stores to be stock checked in each designated day, time of starting and ending stock taking in each day, break-time and lunch time. To prevent double counting, colored stickers shall be adhered on the counted stocks.

In order to account for the pre numbered stock taking sheets and to prevent possible spoilage and misuse, the stock taking sheets shall be given to the recorder on signature and to return the same sheets fully completed to the Head of Stock taking teams.

Comparison between the physical stock quantities with the stock records and bin card shall be done in order to establish whether or not there are discrepancies. Discrepancies shall be investigated and corrective action taken. The stock taking team shall note and date the bin cards **in red ink** that the stocks have been checked. The stock taking sheets shall be raised in duplicate. A sample of stock

6.4. Stock Taking Team Duties

Typical duties of a stock taking team include the following.

1. To physically count the available stock, checking the actual stocks with stock cards and balances and then compiling stocks discrepancies list
2. Obtaining of explanation for stocks deficiencies and surpluses and recommending rectification action
3. Preparing a report on the status of stocks, condition of stock and storage facilities
4. Initialing with date stock checked balances on the Bin Cards, and Stock Cards
5. Recommending action to be taken on stock deficiencies and surpluses
6. Reporting on the condition, sufficiency, security and management of stores
7. Reporting on the existence of dormant and slow moving stocks.
8. Reporting on inferior stock qualities.
9. Reporting on the accuracy and up to datedness of stock records

6.5. Reasons for Stocks Discrepancy

The major possible causes for stock discrepancy are the following. Identifying these reasons enables the stock taking team, store keepers and store accountants to trace mistakes rectify errors quickly.

1. Failure to complete properly the required paper work at each step of the flow of stocks

2. Failure to post stock receipts and issues
3. Incorrect posting of stock receipts and issues
4. Computation errors in the day to day posting
5. Spoilage as a result of natural processes or from unsatisfactory storage
6. Shrinkage due to computation errors arising from different units of measurement for stock receipts and issues. For example, receipts of fuel in drums and issues of fuel in liters
7. Losses due to paper work stocks receipts without the stocks physically entering the public body's premises
8. Losses due to unauthorized issues and pilferages
9. Losses arising from theft by outsiders due to inadequate physical protection of stocks

6.6. Stock Control

A major objective of any stock management system is to assure that materials are on hand when they are needed. In order to maintain adequate control over the level of stock, standard order quantities and order points must be established. Whenever stock on hand falls to a minimum level, based on the time lag between order and the delivery of the item, an order should automatically be placed for a predetermined amount.

The extent of stock holding is determined by the following four considerations; operational needs, time requirement, available storage accommodation, and cost of ordering. These are described in detail in the following paragraphs.

Operational needs, which is the immediate availability of all materials without interruption of operation.

Time required obtaining materials: Some goods are available from the stock of the supplier, others require even foreign purchase. The time required between the date of order and receipt of the good varies among different stocks. Therefore it is important to estimate lead time. Lead time is an estimate of the interval between the time that a determination is made as to the need for material and the time such material is delivered. The calculation has two aspects, administrative lead time and supplier lead time. The former is the time lapse between the requisitioning of material and the preparation of a purchase order. Supplier lead time is the additional time lapse before the material is delivered.

To prevent a stock out, public bodies must have an inventory that is at least adequate for usage during the lead time. For example, if the lead time of an item is six weeks, with a usage of 20 units each week, there must be an inventory of at least 120 units when the order is placed to prevent a stock out. If usages and lead times were predicted exactly, it would be possible to limit maximum inventory of an item to the order quantity and a new shipment would arrive just as the last unit of existing stock being used. In practice this cannot be done because suppliers may not keep delivery promises and usage

forecasts may be inaccurate. Extra inventory is needed to protect against these contingencies. This extra inventory is called "safety stock". The amount of safety stock required is determined by the consideration of: (1) lead time and the expected lead time variance; (2) rate of usage during the lead time and expected usage variance; and (3) reorder frequency.

Available Storage Accommodation- Arrangements must be made to see that deliveries, whatever the quantities ordered, are not too great in amount to be accepted into the available storage accommodation. If this point is not considered carefully, goods requiring covered storage may have to be kept in the open air, or rent may have to be paid for warehousing facilities.

Cost of ordering- it is the cost of placing an order. If the ordering cost is high, public bodies tend to buy large quantities of stock.

Activity

1. People count and check their cash properly, but they are not applying the same practice for materials in a store. Why?
2. Explain methods of store accounting?
3. Distinguish stock taking and verification.
4. What is the difference between spot and periodic spot checking?
5. What is the difference between annual and periodic stock taking?
6. What are the expected causes of stock variation in your organization?

7. What are the measures taken to minimize future stock discrepancies?
8. In what conditions annual stock taking differ from continuous stock taking

CHAPTER SEVEN

LOCATION AND LAYOUT OF STOREHOUSE

7.1. The meaning of Location and Layout

Efficiency and productivity of a plant mainly depend on the working of various departments in the plant, which are directly involved in the production activities. Departments, which are not directly, involved directly in the production activities but provide services which are equally important for the efficiency and productivity of the plant. The stores division is one of the most important divisions serving the needs of all the departments in the plant and influencing the efficiency and productivity of the plant, which greatly depends on four important factors: *Number of stores and their sizes, Location of the stores, Layout of the stores, and Facilities provided in the stores.* From these four factors it is the location and layout of stores that has given emphasis in this chapter.

Therefore, selecting the required location and layout of the stores contributes greatly to the productivity of stores operations and their efficiency.

Storehouse layout refers to the arrangement of physical facilities such as machinery, equipment, furniture etc. within the factory building in such a manner so as to have quickest flow of material at the lowest cost and with the least amount of handling in processing the product from the receipt of material to the shipment of the finished product.

When dealing with the Stores layout, there are two aspects to be considered. One is the layout of storage areas or store-rooms which focus on methods to find appropriate layouts for storage areas. This concerns the determination of the number of blocks, and the number, length and width of the aisles and cross aisles in the area. One layout concept that is regularly seen is a one-block “square-in-time” layout. Square-in-time basically means that it takes the same time to walk from the front to the back of the area as it takes to walk from the left to the right of the area. It can easily be proven mathematically that this layout is optimal if there is only one stop per route (that is, if we are moving full pallets only). However, it is possible to do better nevertheless, as will be shown in the section “Layout for unit load areas”. But first we will look into layout issues for order picking areas.

The second is the layout of bins and racks in each store. The layout of the racks in a warehouse has a major impact on the efficiency of the operations (it will often be possible to obtain

a substantial reduction in order throughput time and simultaneously a reduction of costs).

7.2. Location of a Storehouse

Stores should be located at convenient places near to the place of operations. For example, raw materials yards should be very close to the materials preparation activities of the plant, which is near, the crushing section or grinding section. In case a number of raw materials are used in manufacturing the product, the raw material – which is used in maximum quantity, *should* be located close to the production facilities. Raw materials used in small quantities can be stored farther away. This will help in saving on handling operations and the cost involved therein. A separate store may be there for quarry operations or for the transport department. Explosive stores and oil storage tanks should be in a separate and isolated place for safety reasons. The main warehouse is normally very close to the workshop, mechanical and electrical repair shops. The finished product storage should be near the packing plant. Similarly, packing materials store should be close to the packing plant. Some of the stores are under the direct control of the operational departments. For example, raw materials stores are normally under the control of production department, who would provide regular information to the stores division for keeping the records up-to-date. These arrangements are made keeping in view the overall efficiency of the plant.

Normally stores are located away from the main entrance of the plant, where visitors or customers are frequently coming to the plant. Stores are normally located near the side or rear entrance so that waiting trucks have no problem of parking space. Normally, the area near the store is not as clean as it should be near the main entrance of the organization. This makes it more important to have a separate entrance for the storage area.

Efforts should be made to locate the stores near the rail-line and highways to facilitate receipt and dispatch of materials and reduce handling costs and labor. Wind direction is another important consideration in locations for stores for raw materials. If all the sides of the storage yard are open, lot of materials in powdery form will fly away with the wind thus causing loss of materials as well as creating environmental pollution. Proper selection of site for raw materials storage can eliminate many future problems.

7.3. Basic Principles of a Good Stores Layout Plan

The goal of warehouse layout design is to optimize your warehousing functions and achieve maximum efficiency and space utilization.

A warehouse is typically divided into areas to support your every day processes. These areas include: reserve storage, forward pick, cross docking, shipping, receiving, assembly/special handling lines, and quality/inspection area.

Designing a new facility starts with analyzing your current and projected data on the activities in each of these areas,

including the receiving, shipping and inventory levels. This data should be supported by other considerations such as process flows, material handling equipment, type and styles of racking equipment, special handling requirements, and personnel.

When considering the layout and operation of any warehouse system, there are fundamental principles that embody a general philosophy of good practice. The principles are:

1. Using the most suitable unit load
2. Making the best use of space
3. Minimizing movement
4. Controlling movement and location
5. Providing safe, secure and environmentally sound conditions
6. Maintaining at minimum overall operating cost

Successful warehouse layouts must adhere to the principles, regardless of material being stored to:

- i. Maximize the use of space
- ii. Maximize the use of equipment
- iii. Maximize the use of labor
- iv. Maximize accessibility to all items and
- v. Maximize protection of all items

Although the objectives of warehouse layout and operation are easily recognized, warehouse layout problems are often complicated by large varieties of products needing storage,

varying areas of required storage space and drastic fluctuations in product demand.

Therefore, an effective layout design of the warehouse is required to address these problems and accomplish the objectives.

Space Requirements Planning

The first step in laying out a warehouse is to determine the overall space requirements for all warehouse processes. The space requirements for each process should be computed and summarized to estimate the overall building requirements. Effective space utilization makes good use of total building volume and not merely the floor area.

For example, when calculating the space required for the receiving and shipping staging area, the number of receiving and shipping dock doors and the turnaround time for each dock would be considered. A common practice is to allocate enough staging space behind each dock door to accommodate a truckload's worth of material.

Some other processes that would be considered in the space requirement planning *include case picking, pallet storage, broken case picking, packing and unitizing, customizing, cross docking* and more.

Warehouses should also be designed based on current and future needs to:

- Facilitate changes in business/agency growth, and size/population of office and warehouse spaces within

the building. Warehouse space should be easily adapted to new functions such as office (on ground or upper levels), computer centers, or light industrial/fabrication.

- Accommodate need for future loading docks, truck space, and car parking spaces if space configuration changes through effective site design.
- Address material handling technologies and business practice, such as "just-in-time" storage, which have fundamentally changed operation of warehouses and distribution centers, and will continue to do so.
- Include roof design with built-in extra structural capacity to handle addition of future rooftop equipment.
- Be designed with fire protection capacity to accommodate storage of materials with a greater fire hazard, especially needed with high plastic product content or packaging, and plastic shrink-wrapped pallets.
- It should also be able to maximize utilization of space while providing adequate circulation paths for personnel and material handling equipment such as forklift trucks. We should also use higher bays to take advantage of height allowances in the space.
- Alternative material handling methods will determine other building aspects, such as aisle widths, lighting design, need for mezzanine space, fire protection, and egress design. Businesses will often use different methods of storage handling simultaneously for different products.

Factors affecting warehouse layout & planning

Outside Factors

Various external factors influence the design and layout of a warehouse operation. These factors have to be taken into considerations to achieve an optimum overall system.

- ***Size & configuration of site***: must be adequate to accommodate the required equipments
- ***Site access***: must be adequate for the types of vehicle and volume of traffic using that particular site
- ***Local authority plans***: the proposed warehouse can be greatly affected by the government development plan
- ***Site details***: characteristics of the facilities found in the site such as drainage and ground.
- ***Financial considerations***: consider about the rents, costs of ownership, investments grants
- ***Building factors***: existing building to be use as a warehouse.

Inside Factors

These factors has a dominant influence on how effectively a warehouse can be operated.

- Flow of goods in the warehouse: ‘U’ flow or through flow
- Movement of people and equipments
- Access to stock and minimize congestion
- Identification of stock and codes
- Stock location, rotation(FIFO)

- Stock checking requirements
- Stock replenishment
- Handling of goods in and out of the warehouse
- Supervision, safety, stock security

Warehouse *aisles* and *gangways* need to be properly design in order to achieve one of the warehouse objectives, which is maximizing effective use of space. The widths in between should be adequate enough for movement of people and equipment. It is ideal to have separate doors for people on foot and for forklift trucks.

Some areas should also be set aside for other warehouse activities. These include:

- Areas for loading and unloading vehicle
- Staging or temporary storage areas
- Office space, washroom and lunch rooms
- Area for repacking, labeling, marking
- Area for equipment storage and maintenance
Hazardous or high-value items

7.4. Layout Planning of Warehouse

Layout planning is one of the key issues for efficient operations of the warehouse. Layout will differ from one warehouse to another, depending upon the available space, type of items stored, number of items, and nature of operations. However, in normal situations, some of the points to be considered in layout planning are:

- Receipt and issue section should be as close to the main entrance as possible, to enable easy receipt and issue of materials. Outsiders, like truck drivers, should not enter the warehouses and should deliver the goods in the receipt section.
- Inspection bay should be arranged near the receipt section. This would help in minimizing the handling and movement of the materials. Inspection of the incoming materials is faster as materials are quickly transferred to inspection area.
- Warehouse issue counter should be away from receiving and inspection area. The user representative should be able to get the materials issued without any problem. Issue
- Activities of the materials should not be affected by the activities of receipt and inspection. The issue counter should be in a covered area, so that the staffs do not have to stand in the sun or rain while getting the materials issued.
- There should be separate rooms for keeping the accepted materials, separately from the rejected materials that are to be returned to the suppliers.
- The office of the stores Manager should be near the entrance to keep an eye on all the persons coming in and going out as well as on the incoming and outgoing materials. Entry of unauthorized persons to the stores is greatly restricted through a proper watch by the stores manager.
- Heavy castings and components like pumps, compressors, and motors etc., should be kept on the ground floor, which should have concrete flooring.

This will require less effort and time in unloading and keeping the materials properly in the store. This will reduce the possibility of any damage to the material in handling during shifting the materials to the upper floors if they were to be stored there.

- Light materials should be stored in racks on upper floors. Attempts should be made to use three-dimensional space to the maximum extent possible by storing the materials in racks and closed store-walls.
- Materials, which are likely to be affected by exposure to sun, humidity or rain, should be stored in a covered area.
- Materials, of attractive nature, which are prone to be pilfered or stolen, should be kept in a more protected area, not within easy reach of any outside staff.
- There should be enough space for movement of materials and men in the storage area. The forklift trucks and trolleys should be able to move easily.
- The materials should be arranged in the storage area in such a way that minimum movement of the material is involved in the storage area. The materials, which are received / issued frequently, should be near to the receipt/issue areas; whereas materials, which are received/issued occasionally, should be stored away from receipt/issue sections.

7.4.1. Physical Facilities Planning

The following guidelines are important in planning the facilities:

- Stores should be properly lighted to avoid any dark spots or shadows, which can be a source of accidents. Attempts should be made to allow natural light to the maximum extent possible.
- Proper ventilation is very essential in the stores. Exhaust fans should be provided at appropriate places, especially in areas, where bad smell can affect normal working or can damage other materials. For example, areas of belt conveyors, rubber materials, and chemicals are likely to give out a bad smell during storage. Chemicals may get spilled over on the floor during handling, storage, or physical verification of items in the stores.
- Storage area for liquids like chemicals, oils etc., should be of concrete or cemented with a slope for provision of washing, in case of spillage of materials on the floor.
- Stores should be provided with an adequate capacity EOT crane for unloading of the materials from the truck as well as loading of the materials onto the trucks.
- Sufficient clearance above the crane and on the sides should be provided for efficient operations and maintenance activities of the facilities.
- The warehouse entrance door should have a collapsible and electrically operated door to facilitate easy closing and opening of the door. There should be a separate door for entry or exit of persons walking in or out.
- Door width and height should be enough to enable trucks with materials to enter the warehouse for unloading.
- Height of the warehouse shed should be about 6 meters to enable operations of chain pulley block for loading and unloading of the materials.

- Stores should have computer terminals at appropriate places for record keeping and retrieval of information quick.
- Some of the store areas should have controlled conditions. For example, electronic spares should be stored in an air-conditioned area.
- Compressed air is required for filling in tyres of the vehicles or for cleaning purposes. In some cases, compressed air is required for testing purposes.
- Open yards and scrap yards should be evenly floored without any raised or deep areas. Parts of the open yard should be cemented to avoid stagnation of water. It is specifically important in storage areas of steel items.

7.4.2. Types of Layout Plans

Optimizing the organization of a store helps to ensure that Storekeepers or the authorized person to issue or to withdraw the items can find what they are looking for quickly and navigate the store with ease. This could enable the stores management to achieve the basic storage objectives which is to increase effectiveness and efficiency of the store. Certain layouts work better for different types of stores and the buildings they reside in, but each is implemented with the same goal in mind: to increase effectiveness and efficiency. Therefore, the basic types of store layout are:

Grid Layout

A store organized using a grid layout is very simple. The aisles of the store are arranged parallel to one another and

lead to the checkout lanes located at the front of the store where forklifts and material handler trucks enter and exit. Most people have seen this type of layout used in grocery or chemists.

Diagonal Layout

Diagonal layouts are very similar to grid layouts. Like a grid layout, the goods in the store are separated into aisles which lead to the checkout area. However, in a diagonal layout, the aisles are set at an angle to the front entrance of the store. Doing this helps maximize the space available in a smaller store.

Mouse Trap Layout

In a mouse trap layout, when the forklifts enter the store there is only one direction to go. Forklifts or order pickers/issuers walk around the perimeter of the store, stopping to pick up items they need until they reach the checkout aisles located where they originally entered. Mouse trap layouts are often used in furniture stores and are considered a more traditional style store layout.

Mixed Floor Plan

A mixed floor plan layout incorporates different types of layouts throughout the store. This is often seen in a department store setting where different floor plans work better depending on the type of merchandise on display in that particular area. For example, the warehouses section of a department store might use a grid layout while the clothing

sections work better with a racetrack layout. Having the flexibility to use different layouts for each type of merchandise ensures that customers find what they are looking for quickly and easily in every department.

Activity

1. What is plant layout?
2. Mention any four objectives of plant layout
3. Discuss major principles of plant layout
4. What do you mean by process layout?
5. Write the major difference between process layout and service layout
6. What makes process layout difficult than other forms of layouts?
7. Define product layout?
8. Write the major advantages and disadvantages of product layout?
9. What is combine layout and when to apply this layout system?
10. Compare and contrast process layout, product layout and fixed layout?
11. What is group layout and how to apply this type of layout system?
12. How to design layouts?
13. Elaborate each layout designs with an example?
14. How production planning and control, materials management and maintenance management contribute to the effectiveness of plant layout?
15. Discuss Storehouse Bin location system, fixed location system, Combination of fixed and random location system, Random system.

CHAPTER EIGHT

STORAGE AND MATERIALS HANDLING EQUIPMENT

Material handling equipment is equipment that is related to the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. Material handling equipment is the mechanical equipment involved in the complete system.

Material handling equipment is used to increase output, control costs, and maximize productivity. There are several ways to determine if the material handling equipment is achieving peak efficiency. These include capturing all relevant data related to the warehouse's operation (such as SKUs), measuring how many times an item is "touched" from the time it is ordered until it leaves the building, making sure you are using the proper picking technology, and keeping system downtime to a minimum.

Material handling equipment is generally separated into four main categories: storage and handling equipment, engineered systems, industrial trucks, and bulk material handling. But in this chapter we will see only the *Storage equipment* under the first section and the *Handling equipment* under the second section.

8.1. Storage Equipment

8.1.2. Functions of Storage Equipment

The most common reason for storing a product allows the other elements of production to operate more efficiently on a per-unit basis because the fixed costs associated with utilizing the element can be spread over more products; e.g., storing up to a truckload of product in a facility reduces the per-unit costs of shipping; and buffering or storage of WIP enables batch production which reduces the per-unit setup costs.

Other potential reasons for storage include: time bridging allows product to be available when it is needed (e.g., storing spare machine parts at the facility); processing for some products (e.g., wine), storage can be considered as a

processing operation because the product undergoes a required change during storage; and securing e.g., nuclear waste storage.

8.1.3. Types of Storage Equipment

The most important thing in any warehouse is storage space. Warehouse storage equipment is durable so that it can carry support heavy loads. Storage systems must be accessible enough for safe and quick access to the stored equipment.

Storage equipment, as the name suggests is used to store materials, components and assemblies. The level of complexity of this type of equipment is wide ranging, from a welded cantilever steel rack to hold lengths of stock materials to a powered vertical carousel system. Also within this category are

A. PALLETS RACKS

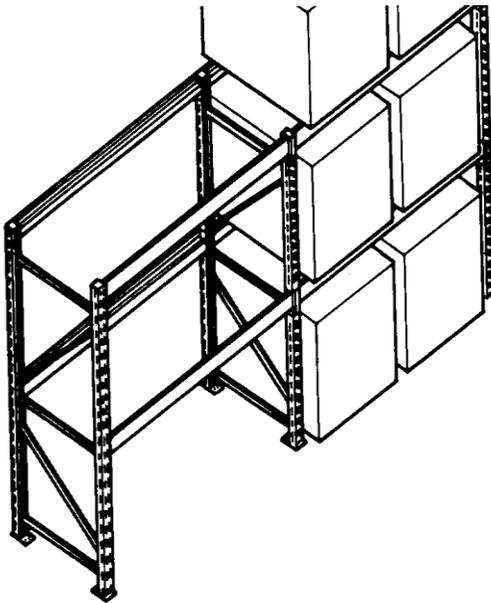
A pallet is a piece of equipment especially designed to facilitate mechanical handling by forklift trucks, and may be used for both storage & transportation purposes. On the other hand a Rack is the generic name given to any kind of storage fixture. Racks are used for the accommodation of tubes, bars, sheets, plates and tires.

Pallet rack systems offer warehouses a cost effective means of managing inventory. Pallet racks adapt any specific interior layouts which make them the most versatile form of warehouse storage equipment. Pallet racks are very easy to assemble. They are made through a computer assisted system

that offers additional advantage of customizing the size of your pallet rack.

Storage racks are used when support and/or material accessibility is required. The major types of pallet racks are:

i. Selective pallet rack



It is the most popular type of storage rack. Pallets are supported between load-supporting beams

Special attachments and decking can be used to make the racks capable of supporting other types of unit loads besides pallets (e.g.,

coils, drums, skids)

Selective racks can be used for the following types of storage:

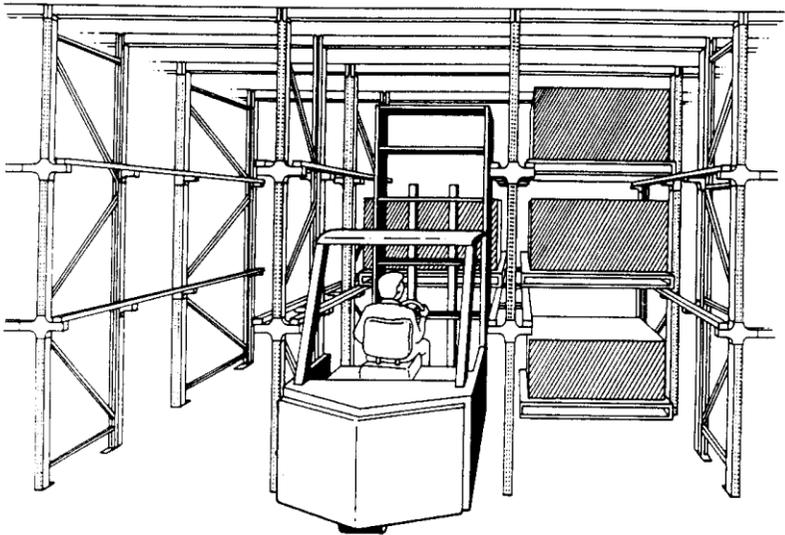
Standard single-deep storage using a counterbalanced lift truck

Narrow-Aisle—storage using a narrow-aisle lift truck.

Deep-Reach—greater than single-deep storage (typically double-deep storage)

Figure 8.1. Selective pallet rack

ii. Drive-through rack



Loads are supported by rails attached to the upright beams

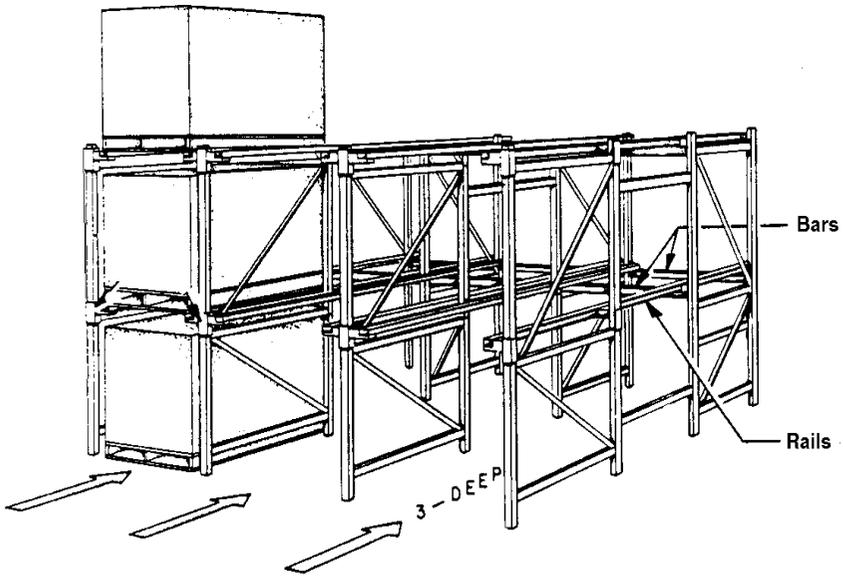
Lift trucks are driven between the upright beams

Requires similar-width loads

Open at both ends, allowing access from both ends (FIFO)

Figure 8.2. Drive-Through-Rack

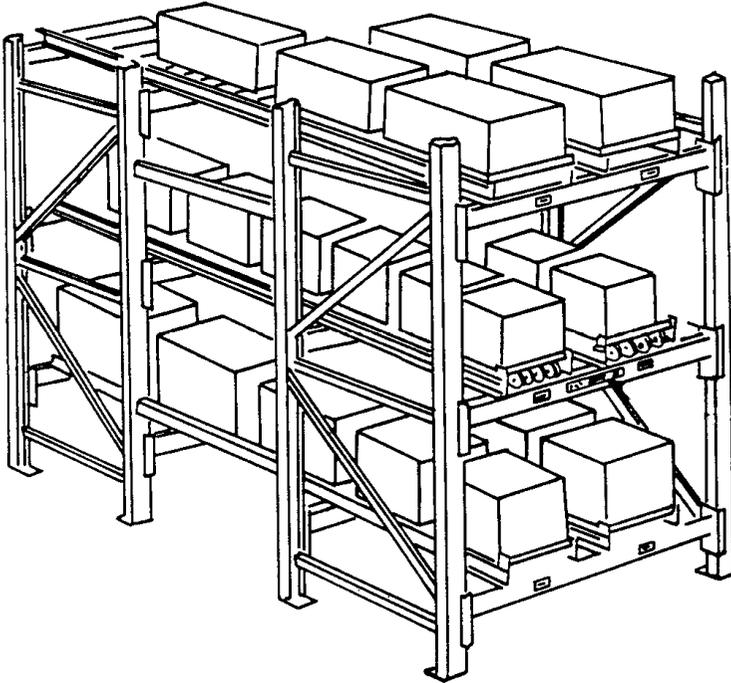
iii. Drive-in rack



Same as drive-through rack, except closed at one end, allowing entry from only one end (LIFO)

Figure 8.3: Drive-in rack

iv. Flow-through rack

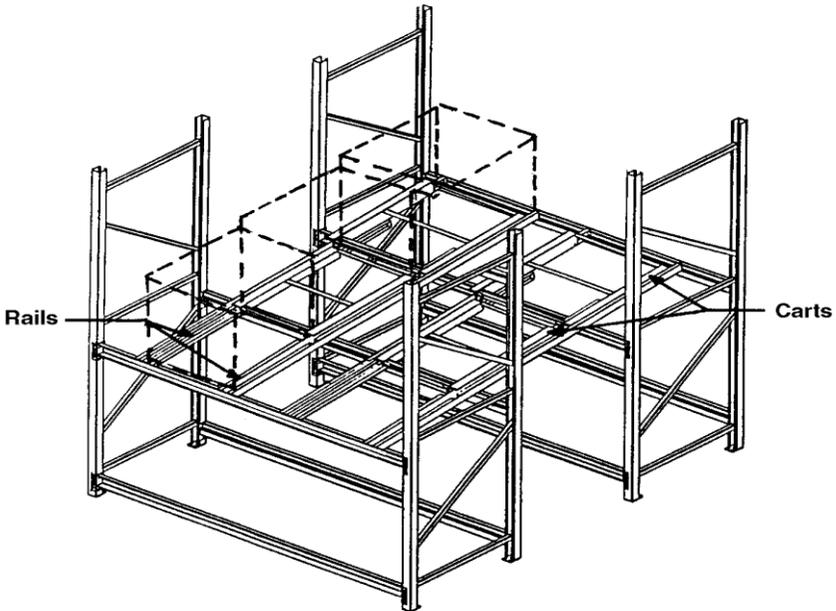


Loads are supported on an incline to enable gravity-based movement of the loads within the rack (via, e.g., a gravity roller conveyor)

Loaded at the higher end and unloaded at the lower end (FIFO)

Figure 8.4: Flow-Through-Rack

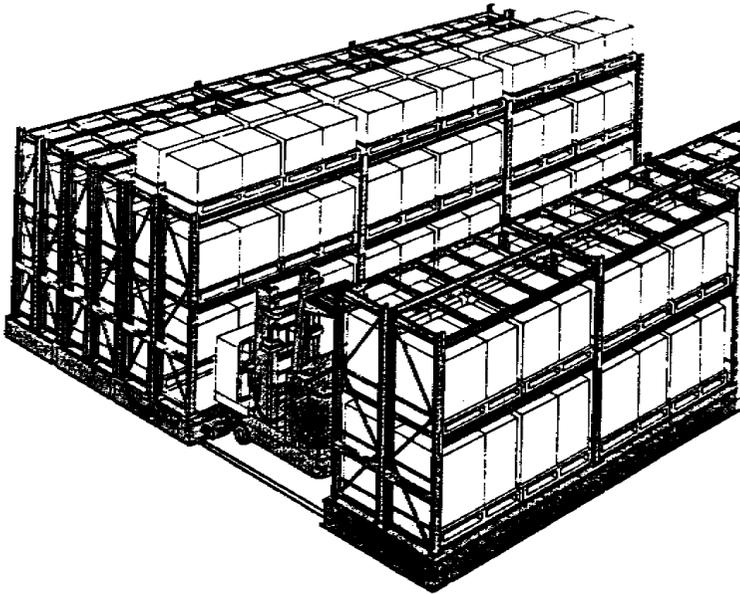
v. **Push-back rack**



Same as push-back rack, except loaded and unloaded at the lower end and closed at the higher end (LIFO)

Figure 8.5: Push-Back-Rack

vi. **Sliding rack**

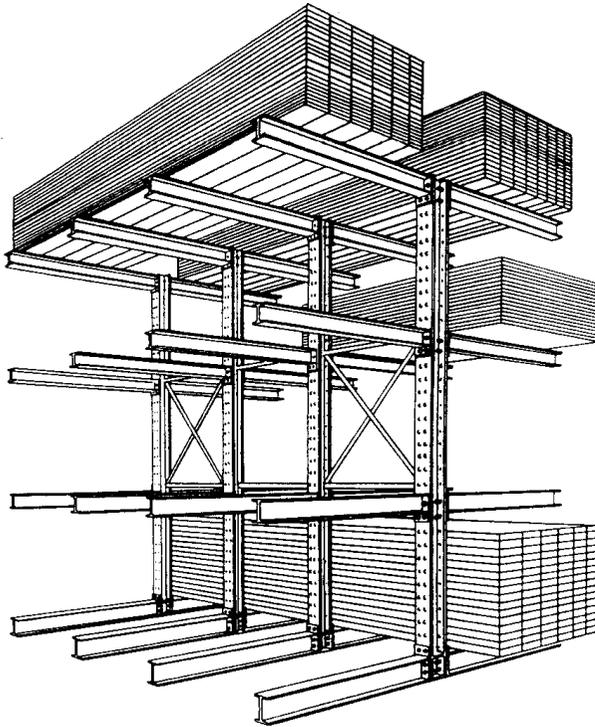


Only one mobile aisle is used to access several rows of racks

Location of the aisle is changed by sliding the rows of racks along guide rails in the floor

Typically found in library stacks

Figure 8.6: Sliding-Rack



vii. Cantilever rack

Loads are supported by cantilever "arms"

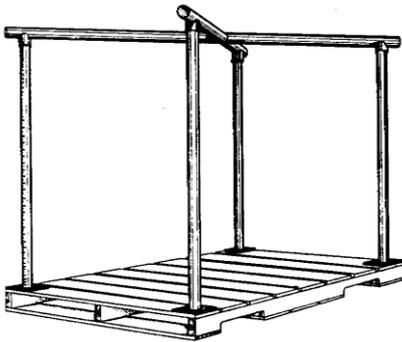
Used to store long loads (e.g., bar stock, pipes, lumber)

Similar to pallet racks, except the front

upright beams and the front supporting beams are eliminated

Figure 8.7: Cantilever-Rack

B. STACKING FRAME



multilevel block stacking

Interlocking units that enable stacking of a load so that crushing does not occur

Can be disassembled and stored compactly when not in used

Pallet frames can be used to enable

Figure 8.8: Stacking Frame



C. SHELVES/B INS/DRAWERS

Storage cabinets are made up of high-density steel. Storage cabinets offer quick access to the contents

and maintain cleanliness and security, and come in different sizes.

Warehouse storage equipment is designed for supplies, products, substances and components. Warehouse storage equipment is highly adaptive and can be used in any warehouse or factory environment.

The supplies and the equipment stored in different warehouses vary greatly. This is why a single type of storage system will not be enough for a warehouse. You would have to use different types of storage cabinets and storage systems for storing different items properly.

Figure 8.9: Shelves and Drawers

Mobile storage systems are also a very good option for warehouses. You can move the mobile storage systems anywhere within the warehouses or between warehouses very easily.

Open and closed shelving

- i. ***Open type shelving:*** They are suitable for storing packaged items, such as small tins of paints, files, drills, boxes of cleaning materials.
- ii. ***Closed type shelving:*** The most widely used form of storage fixture, and it can accommodate items such as hand tools, pipe fittings and machinery spares.

D. STORAGE CAROUSEL



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baskets or bins

Materials (and the storage medium) move to the operator, "part-to-man," for end-of-aisle picking

Each level of the carousel can rotate independently in a clockwise or counter-clockwise direction

Control ranges from manually activated push buttons to automated computer controlled systems

Provides an alternative to typical "man-to-part" AS/RS, where the S/R machine moves to the part Similar to a trolley conveyor with storage baskets

Figure 8.10: Storage carousel

8.2. Materials Handling Equipment

Expressed in simple language, *materials handling* is loading, moving and unloading of materials. To do it safely and economically, different types of tackles, gadgets and equipment are used, when the materials handling is referred to as *mechanical handling of materials*.

One of the definitions adopted way back by the American Materials Handling Society is: *Materials handling is the art and science involving the moving, packaging and storing of substances in any form*. Some of the other definitions are:

- Materials handling is the movement and storage of materials at the lowest possible cost through the use of proper methods and equipment.
- Materials handling is the moving of materials or product by any means, including storage, and all movements except processing operations and inspection.
- Materials handling is the art and science of conveying, elevating, positioning, transporting, packaging and storing of materials.

8.2.1. The Materials handling system

The term “system” has many meaning depending on the field where applied. A general definition of the term could be: *a complex unity formed of many often diverse parts subject to a common plan or serving a common purpose*. The important characteristic of a system is that the parts, called subsystems, are interrelated and guided by an objective for which the system exists.

In an industry, materials handling is a subsystem (or part) of the production system. Materials handling itself can also be considered to be a system whose subsystems are (i) design or method to be adopted, (ii) types of materials handling equipment to be used, (iii) different operations like packing /unpacking, movement and storage involved, (iv) maintenance required for the equipment employed, (v) mode of transportation by the raw materials suppliers, distributors/customers, waste / scrap collectors etc. The common objective by which the different subsystems are guided is the lowest cost solution of the materials handling system for that industry.

In actual practice, the system concept of materials handling means the different types of materials handling needed at different parts of an industry and associated suppliers' and customers' end are to be considered in totality. Only this approach will ensure an overall cost effective materials handling solution for the industry.

Materials handling systems provide transportation and storage of materials, components and assemblies. Material handling activities start with unloading of goods from delivery transportation, the goods then pass into storage, onto machining, assembly, testing, storage, packaging, storage, and finally loading onto transport. Each of these stages of the production process requires a slightly different design of handling equipment, and some processes require integration of multiple items of handling equipment.

Design or selection of the right material handling system is one of the most important decisions that a manager can make, because of the effects on the rest of the manufacturing plant. It affects the material flow and the factory layout. Apart from the initial capital cost for a new system, the consequences of any misjudgment in material handling will have considerable and long-term effects on operations. In recent years computer based simulation tools have been developed to simulate material handling systems and their effect on the manufacturing process.

Loading equipment is aimed at providing the capability to load and unload vehicles; it is also referred to as loading bay equipment. The essential requirements of a good materials handling system may be summarized as:

- i. Efficient and safe movement of materials to the desired place.
- ii. Timely movement of the materials when needed.
- iii. Supply of materials at the desired rate.
- iv. Storing of materials utilizing minimum space.
- v. Lowest cost solution to the materials handling activities.

8.2.2. Importance of Materials Handling

The foremost importance of materials handling is that it helps productivity and thereby increases profitability of an industry. Many enterprises go out of business because of inefficient materials handling practices. In many instances it is seen that competing industries are using same or similar production

equipment, and one who uses improved materials handling system stays ahead of their competitors. A well designed materials handling system attempts to achieve the following:

- i. Improve efficiency of a production system by ensuring the right quantity of materials delivered at the right place at the right time most economically.
- ii. Cut down indirect labor cost.
- iii. Reduce damage of materials during storage and movement.
- iv. Maximize space utilization by proper storage of materials and thereby reduce storage and handling cost.
- v. Minimize accident during materials handling.
- vi. Reduce overall cost by improving materials handling.
- vii. Improve customer services by supplying materials in a manner convenient for handlings.
- viii. Increase efficiency and salability of plant and equipment with integral materials handling features.

Apart from these, for certain industries, like process industries, heavy manufacturing industries, construction industries, mining industries, and shipbuilding or aircraft industries etc., the materials are so large and heavy that these industries just can not run without appropriate materials handling system.

All the above points clearly show the importance of materials handling in an industry or a material transportation system.

However, the negative aspects of materials handling should also not be overlooked. These are:

- i. Additional capital cost involved in any materials handling system.
- ii. Once a materials handling system get implemented, flexibility for further changes gets greatly reduced.
- iii. With an integrated materials handling system installed, failure/stoppage in any portion of it leads to increased downtime of the production system.
- iv. Materials handling system needs maintenance, hence any addition to materials handling means additional maintenance facilities and costs.

8.2.3. Types of Materials Handling

The category can be divided into products that provide access from the loading bay to the vehicle and equipment that moves the product from the loading bay to the vehicle and vice versa. Equipment that falls into the access category are scissor lifts, goods lifts, dock levelers, loading ramps, doors, dock seals and vehicle restraints, and equipment that falls into the movement category are pallet trucks, conveyors and fork lift trucks.

1. Hand Trucks

Non-pallet + manual + no stack

Hand trucks may be constructed of wood or metal. They are used in phases that mechanical equipment cannot be operated because of space limitations. The four-wheel platform hand truck (Figure 8.12) may be used to advantage in breaking out

retail issues for bins, carrying light loads, or for any operation involving short hauls with frequent stops. It may also be used in multistory warehouses and for small-lot stock picking. The truck may be equipped with solid rubber tires or steel wheels. The two-wheel hand truck (Figure 8.11) consists of two handles a platform on which the load rests, and wheels attached to the bottom of the framework. A blade extends at an angle from the bottom of the platform to hold the load. A stock picker truck is a hand truck used for picking stock from shelves when filling orders. The Storekeeper pushes the truck in the aisles between the shelves to carry small issues in cardboard containers, paper envelopes, or tote boxes. Some models are equipped with a ladder so the stock picker can reach materials on high shelves safely.

1(a) Two-Wheeled Hand Truck



Figure 8-11: Hand truck, two-wheel

1(B) Floor Hand Truck (Four wheel truck)



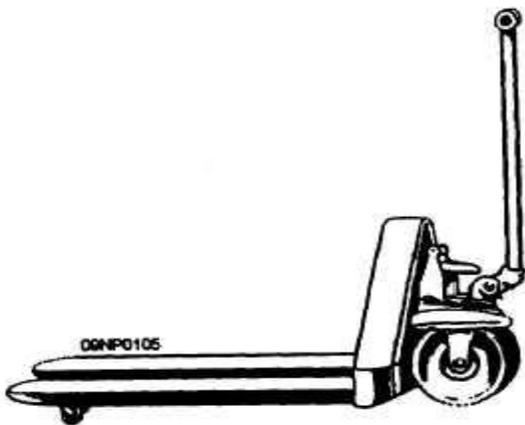
Figure 8.12: Hand truck, four-wheel

2. Hand Pallet Truck

Pallet + walk + no stack

The hand pallet truck is available in the hand/hydraulic model and the electric model. The truck is equipped with two load-carrying forks that can be raised about 4 inches to carry Palletized loads. It is used to move pallet loads that do not have to be tiered and where only short hauls are required. It may be used for the movement of pallet loads in boxcars or into trucks. They may also be used for in-process movements

during tipping and receiving operations. They work well in



conjunction with forklift trucks and can be operated where a forklift cannot because of space limitations. The manual/hydraulic model (Figure 8.13) is used whenever the operating conditions do not require a hand truck with the special characteristics of the powered model. It may be used to advantage in the loading of boxcars, trucks, and aircraft. The electric model (Figure 8.14) is used when the distance the load is to be moved, the size of the load, the presence of grades or inclines along the route, or other considerations require the use of powered equipment.

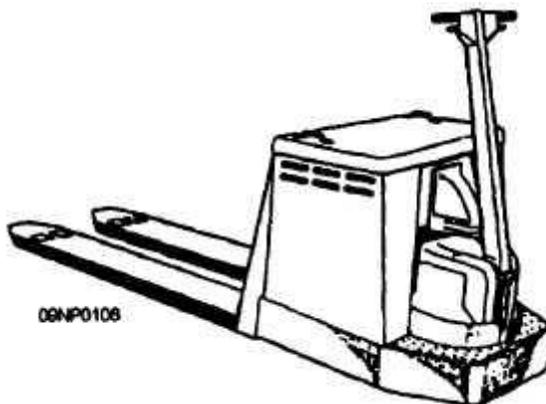
2(a) Manual Pallet Jack

Pallet + walk + no stack + manual

Manual lifting and/or travel

Figure 8.13: Hand pallet truck, manual/hydraulic.

2(b) Powered Pallet Jack



Pallet +
walk + no
stack +
powered

Powered
lifting

and/or travel

Figure 8.14: Hand pallet truck, electric.

3. Walkie Stacker

Pallet + walk + stack

3(a) Manual Walkie Stacker

Pallet + walk + stack + manual

Manual lifting and/or travel
(and straddle load support)

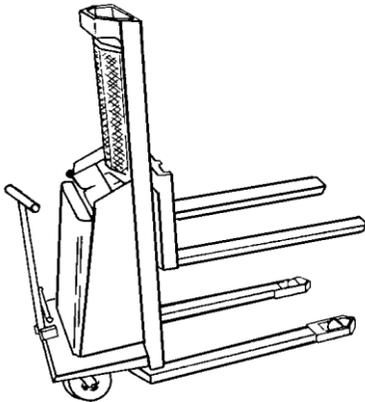
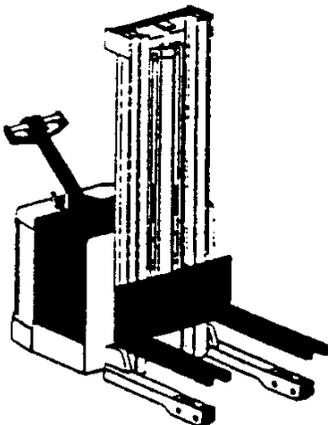


Figure 8.15: manual walkie stacker

3(b) Powered Walkie Stacker

Pallet + walk + stack + powered



Powered lifting and/or travel (and either counterbalance or straddle load support)

Figure 8.16: Powered walkie stacker

4. Forklift Truck

The forklift truck is the most widely used power driven piece of handling equipment used by the supply department. It is designed to pickup, carry, and stack palletized unit loads of supplies and equipment. Standard forklift trucks are available with lifting capacities of 2,000 to 15,000 pounds and lifting heights of 100 to 210 inches. Forklift trucks are equipped with telescopic masts that permit loads to be lifted beyond the height of the collapsed mast. Most trucks have free lift, which is the height to which the forks can be raised before the inner slides move upward from the mast and increase the overall height. Gasoline-powered forklift trucks may be equipped with solid rubber or semisolid tires for use in warehouses, or with pneumatic tires for use in outdoor storage areas. Electric-powered forklift trucks are equipped with solid rubber or semisolid tires for indoor Operations only. ***Forklift trucks are generally used in the handling of palletized unit load.*** They may also be used for hauling boxes or containers

equipped with skids and other large rigid containers or packages. They are used a board ship, on barges, on piers, in warehouses in freight terminals, and on the ground to hoist heavy containers. In yards which are not covered with hard surfaces, the bucks must be equipped with pneumatic tires in order to operate efficiently. While forklift trucks may occasionally be used in place of tractors, their greatest efficiency is obtained in their use for elevating palletized loads into storage and for handling palletized loads between hauling operations. They should not travel with individual loads for distances of more than 400 feet. If the operation requires longer travel, the trucks should be supplemented by tractor-trailer trains or other materials handling equipment, Personnel should use a forklift truck at each end of the haul for loading, unloading, and stacking. A 15,000-pound, pneumatic the, forklift truck is shown in the figure.

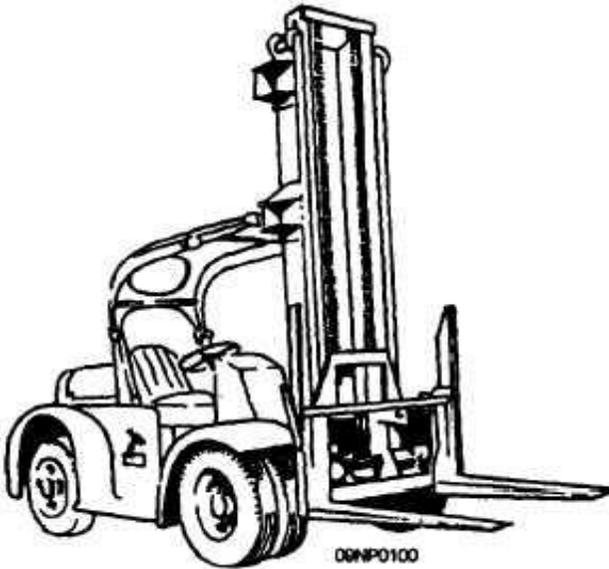


Figure 8.17:

Forklift truck.

5. Tractor-Trailer Trains

The tractor-trailer train (Figure 8.18) is a system of hauling with a self-propelled motor power unit connected to a series of individual load-carrying trailers. Different types of tractors and trailers are used. Tractor-trailer trains can haul larger loads than carrier-type trucks of equal horsepower capacity. They can be operated in trains up to the total drawbar pull of the tractor. The number of trailers one tractor can keep in operation depends upon conditions such as length of haul, nature of material, and weight of the load on each trailer. Under normal conditions, one tractor should be able to keep one set of haulers loading, a second set underway, and a third set unloading.

Tractor-trailer trains may be effectively used on hauls between 400 feet and 1 mile in length. A carrier-type truck is normally used for hauls greater than 1 mile.



Figure

8.18: Tractor-trailer train

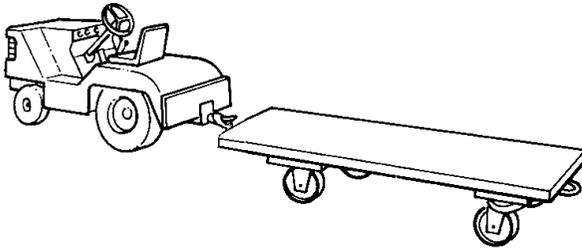
6. Warehouse Tractors

A warehouse tractor is an electric-or gasoline-powered vehicle designed to pull a train of warehouse trailers. The gasoline-powered models most used in the Navy are equipped with pneumatic tires and have rated drawbar pulls of 2,600, 4,000, or 7,500 pounds. Electric-powered models are equipped with solid rubber tires and have rated drawbar pulls of 2,000 or 4,000 pounds. Drawbar pull, the force that the tractor can exert in pushing or pulling loads, is merely a means of indicating tractor capability. The actual capacity of the tractor is normally far in excess of the drawbar pull rating. A tractor with a drawbar pull of 2,600 pounds Figure

8.18:Tractor-trailer train may, for example, have an actual towing capacity of 50 tons.

7. Warehouse Trailers

A warehouse trailer is a load-carrying platform mounted on casters or wheels. Standard trailers are available in a wide variety of sizes and capacities. Some are equipped with solid



rubber or pneumatic tires. The caster-steering type has fixed rear wheels that carry about two-thirds of

the load, and caster wheels at the front through which steering is accomplished. The caster-steering type of trailer is produced in 4,000 and 6,000-pound capacities.

Figure 8.19: warehouse trailer

8. Tying Truck

The tying truck (Figure 8.20) is an electric-powered forklift truck of the straddle-arm design. The forks on the tying truck are located between two outriggers, or straddle arms. The tying truck is more maneuverable than the standard forklift truck and can generally operate in 6-foot aisles.

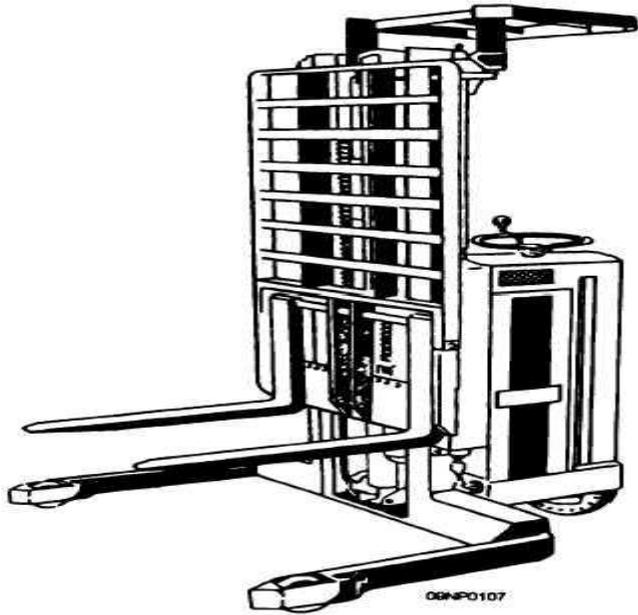
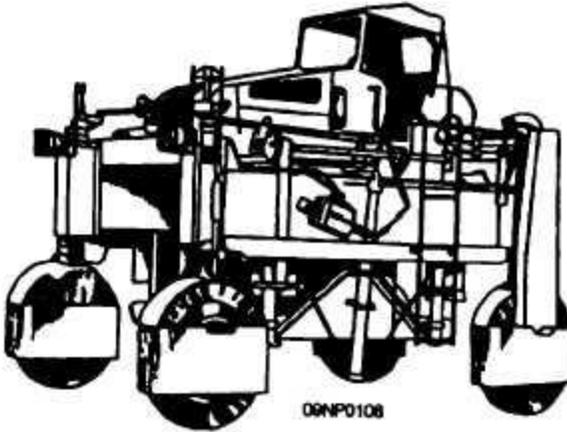


Figure 8.20:-Tiering truck.

9. Straddle Truck

The straddle truck is a diesel- or gasoline-powered four-wheel vehicle designed to straddle, pick up, and transport loads of long and heavy supplies such as pipe, lumber, and steel. The straddle truck (Figure 8.21) is used as an efficient conveyance for intra-station movement of palletized material at many supply activities. Straddle trucks offer a faster and more efficient method of moving unitized pallet loads over intermediate distances than the tractor-trailer train.



Figure

8.21: Straddle truck.

10. Pallet Sling

The pallet sling (Figure 8.22) is used to handle a palletized load for overhead lifting by a crane or ship's boom. Slings are normally made of cable, but line or chain may be used depending on the weight of material to be lifted. Slings have rigid horizontal supports at the base. Usually it is made of steel bars or pipes that must be of sufficient strength to distribute the load across the entire length. Some slings have movable spreader bars at the top to prevent the load from being crushed when lifted.

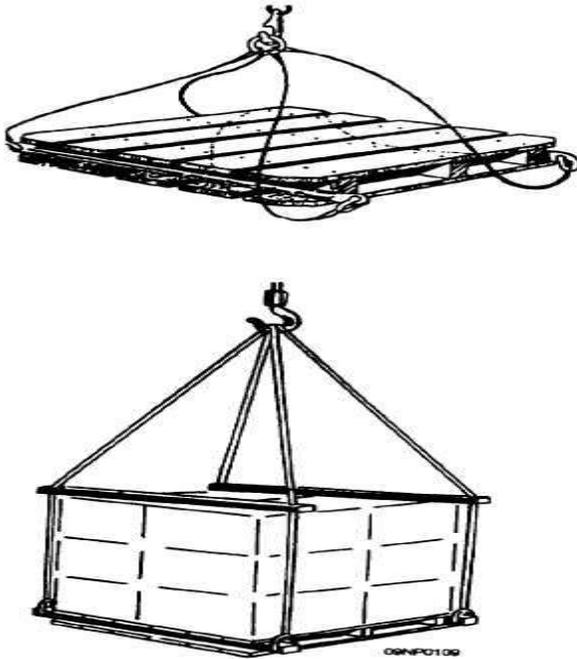


Figure 8.22: Pallet slings.

11. Pallets

A pallet is wooden, steel, or aluminum plat form on which supplies are loaded, transported, or stored in units. Use of pallets permits the handling of material with forklift trucks, cranes, and other transporting equipment. The standard pallet is a 40-by48 inch platform that accommodates most packages and stores in warehouses. It is regarded as the general-purpose pallet. General-purpose pallets may be either the flat type or box type. Flat Pallets may be single-faced or double-faced. Single-faced pallets (Figure 8.23) have one platform nailed or bolted to stringers, usually made of 2- by 4-inch material. A double-faced pallet (Figure 8.22) has

platforms on the top and the bottom of the stringers and is excellent for stevedoring and transit-shed operations.

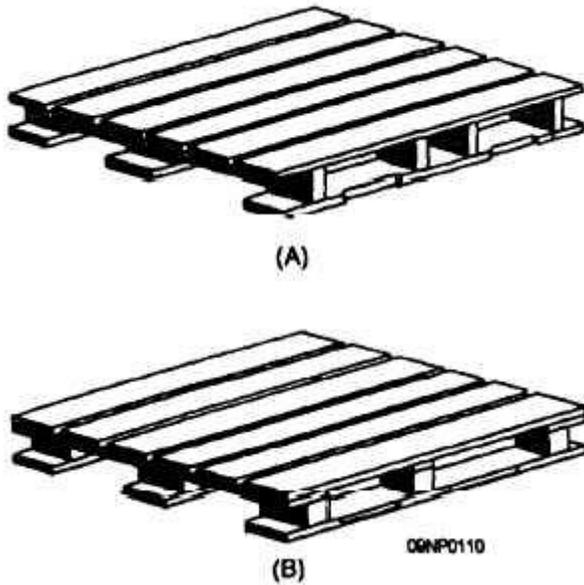


Figure 8.23: Pallet, x 48-inches, four-way entry: Partial stringers (B) Post construction.

The box-type pallet, illustrated in figure 8.24, is used for handling small-lot items or easily crushed Figure 8.24, Box pallet cargo. When discharging items from a ship to a transit shed, loading directly into a box pallet saves considerable time and labor. Nestablesheet metal pallets are convenient for three reasons (1) the maintenance cost is low, (2) they save storage space, and (3) you have no problem keeping them sanitary. Figure 8.24 shows a few single-faced pallets stowed

alongside a stack of sheet-metal pallets. As you can see, the saving in storage space is tremendous. Lightweight aluminum pallets also are used, but are expensive and difficult to repair. In addition to the standard pallet there is a 48- by 72-inch stevedoring pallet, which is used primarily for transporting and storing drummed products and for stevedoring purposes.

12. Loading Pallets

When a pallet is loaded, three things must be considered: (1) maximum load, (2) stability, and (3) proper pallet size. The pallet must pass through all doors, aisles, and hatches likely to be encountered. The stability of the material on the pallet must be considered and a decision made as to the type of pallet to use. Figure 8.24 shows the recommended way to load material on a pallet. The size of the boxes being loaded will determine their arrangement on the pallet. A standard loading pattern is not always appropriate.

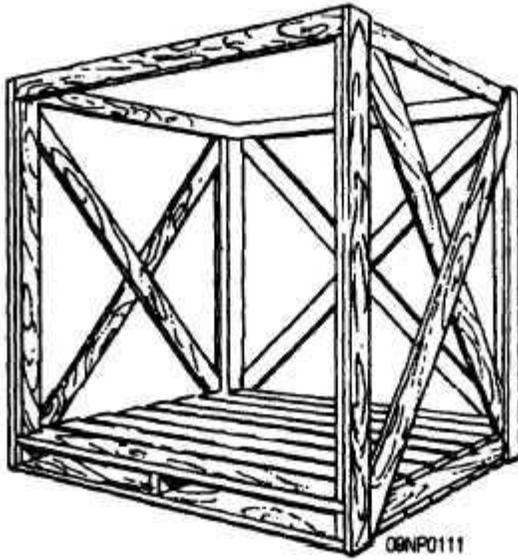


Figure 8.24: Box pallet.

However, in the illustration you can see that the material not only fits the pallet, as recommended in A and B stacking, but is arranged so as to provide stability against slipping or sliding. Boxes of materials are not always the same size. When this is true, place the highest and strongest cases at each end of the pallet and the smaller and more fragile cases in the center. This arrangement provides a stronger surface for a second tier of cases on the pallet and also makes it possible to place a second loaded pallet on top for storage. When you palletize round items, such as gas cylinders, use specially constructed notched spacers or collars as shown in Figure 13-15. Palletized material that must be moved several times should be strapped. Metal or nylon strapping maybe used; the number of straps required for a palletized unit depends upon the kind of handling it is to receive.

Activity

- 1.** Define clearly material handling management and its role for the effectiveness of any operation?
- 2.** Mention some of the objectives of effective material handling management?
- 3.** Explain major principles of material handling
- 4.** What criteria are warehouse managers used to select materials handling equipment's?
- 5.** How to evaluate material handling system within the organization?
- 6.** Write the objectives of good materials handling management?
- 7.** Compare and contrast manual and mechanical material handling equipment's
- 8.** Discuss some of storage materials handling equipment?
- 9.** Discuss fixed path equipment, and Variable path equipment.
- 10.** What are the basic guide lines of effective utilization of material handling equipment's
- 11.** Discuss plant layout and material handling relationship?