

STORAGE MANAGEMENT

1. Introduction.

a. Storage is the keeping or placing of property in a warehouse or open area, assuring that it will be in serviceable condition and readily available when needed. In order to accomplish this, storage requirements must be evaluated to determine the most suitable manner of storage for the type of materiel to be stored. The latest designs in materials handling equipment must be studied and proper equipment selected to store and retrieve materiel in an expeditious manner. Ways to modernize present warehouses must be examined and changes made to facilitate the receipt, storage, and issue of materiel. Attention must be given to the condition of materiel in storage to prevent deterioration. All of these actions must be accomplished to ensure that the supplies are readily available to support the military forces.

b. This unit of instruction addresses various aspects of storage management, including types of facilities, space requirements and utilization, storage layout principles and factors, storage methods, planographs, materials handling, and care of supplies in storage.

2. Objectives. After completing this lesson, you will be able to:

- a. Describe the reasons for storage in physical distribution.
- b. Explain the benefits of an efficient storage operation.
- c. Identify the principles and factors of storage as they pertain to space planning and utilization.
- d. Recognize the different methods of storage.
- e. Discuss the fundamentals of a bin replenishment system.

f. Recall the principles of materials handling.

g. Describe the development and use of a planograph.

h. List the reasons for having a program for care of supplies in storage.

3. References. DLAM 4145.12, Joint Service Manual for Storage and Materials Handling, was developed as a joint effort by all the military services. It is designed for use by managers and operating personnel who are engaged in the storage and handling of military supplies. This regulation dictates sound, basic principles of good storage management and translates those principles into standard methods, procedures, and techniques which have proved by long experience to be the most efficient and effective in the storage and handling of military supplies. These standards are applicable to all DoD organizations engaged in storage operations.

4. Storage in the Distribution System.

a. Storage is a vital link in the distribution chain from the producer to the consumer. The existence of large storage facilities in a distribution system may appear to be an unnecessary or uneconomical method of satisfying military logistics requirements. It would appear that the most economical method of distribution would be direct from the producer to the consumer, cutting out the "middle man." This would eliminate costs for additional handling and for maintenance of fixed storage facilities, as well as reducing the cost of keeping inventories. Such a direct method may be feasible in the supply of items on which there is a predictable rate of demand, and the item is consumed in large quantities by only a few customers in the same geographic area.

b. Strategic and tactical considerations often dictate the requirement for storage facilities. Storage is an instrument by which the fluctuating rate of consumption is kept in balance with a more controllable rate of production. For many items used in support of our military forces, the rate of demand is often erratic and cannot be accurately predicted. Storage also cushions the effect of interruption in production or transportation upon the availability of supplies. By the proper timing and placement of materials, storage helps ensure logistics support of military operations.

c. There are good economic reasons for having storage as a component of military distribution systems. The vast majority of the items in the DoD inventory are secondary items experiencing individual demands in small quantities. Our industrial production lines are not geared to economically satisfy demands of this type directly from the producer to the consumer. Startup and shutdown costs are high since modern production facilities are oriented to mass production operating at a controlled, uniform pace. The absence of a storage component would negate the cost advantages that accrue from purchasing items for resupply in economic order quantities.

5. Storage Objectives. What is it that we are ultimately trying to achieve while operating a storage facility? We can identify several primary objectives of an efficient storage operation.

a. **Maximum Use of Space.** The storage manager is obliged to make the best use of resources. Storage space is in fact a limited resource on the distribution center. Well planned storage space layouts are essential to maximizing space utilization. DoD space utilization standards serve as goals. Space is saved by using materials handling equipment that permits higher stacking and narrower operating aisles. Storage space must be considered in terms of cubic feet attainable. All available storage space -- vertical and horizontal -- should be put to use before additional areas

are designated for storage. Unused space in the storage facility is wasteful and costly.

b. **Savings of Time, Labor, and Equipment.** These factors are also a resource for which the storage manager is accountable. Proper application of these resources will result in higher levels of productivity in the storage operation. Time and labor can be conserved by using the latest, most efficient materials handling equipment. Carefully designed flow patterns, well thought out placement of storage aids, and following proper storage techniques all contribute to increased productivity. Heavy or unexpected workloads can be handled by fewer people when supplies have been properly stored. Also, effort expended for training of employees gives significant paybacks in savings of time, labor, and equipment.

c. **Rapid Accessibility of Materials.** Supplies stored in such a manner that they are rapidly accessible promotes the readiness of the distribution center to respond to the customer's materiel requirements. In turn, the customer's operational readiness is sustained. Rapid accessibility means that stored supplies can be found, identified, selected, and shipped with minimum effort and cost. When proper storage methods have been enforced, it expedites putting away new receipts, conducting location surveys and physical inventories, and performing instorage quality inspections. Achieving response time standards under the Uniform Materiel Movement and Issue Priority System (UMMIPS) is a real-world concern for storage managers.

d. **Protection of Stored Materials.** Materials in storage must be kept in a serviceable condition and not allowed to become unserviceable through neglect. Supplies must be periodically inspected to ensure that they are adequately protected from theft, fire, deterioration, and damage. In addition to good housekeeping practices and common sense, special types of facilities, storage aids, and packaging may be needed to protect the items.

6. Types of Storage Facilities.

a. General. Supplies and equipment received by the distribution center must be stored properly, cared for, and protected so that they will be available for immediate issue in a serviceable condition. Distribution center storage facilities must be designed and used to achieve the most efficient operation for receiving, storing, and issuing supplies and equipment. Storage space at the distribution center consists of both covered and open storage. The following discussion and identification of various types of storage facilities points out the general appearance and functional use based upon approved storage principles and policies.

b. **Covered Storage.** Since the majority of supplies and equipment deteriorate more rapidly when exposed to the elements of weather, they should be afforded the protection of covered storage. Covered storage prevents/delays deterioration; reduces the cost of initial and recurring care and preservation; and extends the shelf life of most items of materiel. There are several types of covered storage facilities. Among them are:

(1) General-Purpose Warehouse.

(a) A general-purpose warehouse is used for the storage of many kinds of items and support functions. It is completely enclosed at the roof, ends, and sides. This type of storage facility normally contains the greater portion of the total available covered storage space at most distribution centers. General-purpose warehouses are either single or multi-story buildings depending upon ground limitations. However, the flow of supplies in a multi-story building is much slower and the floor load capacity is often limited on the upper stories because of comparatively smaller load per square foot capacity.

(b) The warehouse typically has a truckloading platform located on one side and a carloading platform on the opposite side. Both platforms permit materials handling equipment (MHE) to load and unload trucks and railcars at

the warehouse doors. Normally, there are two main aisles that run the entire length of the warehouse, permitting MHE to move without interruption throughout the entire building. By connecting the main aisles with cross aisles, there is direct access to the stacks from the loading platforms.

(c) Functions found in a general-purpose warehouse may include loose issue and/or bulk storage, receiving, shipping, preservation, packing, carton fabrication, unit and set assembly, security areas, and administrative offices.

(2) Refrigerated Warehouse. A refrigerated warehouse is used for the storage of perishable items. It is divided into two distinct areas, with one area as chill space and the other as freeze space. The temperature in the chill space is controlled between 36 and 46 degrees Fahrenheit while temperature in the freeze space is controlled below a level of 32 degrees Fahrenheit. Even though a refrigerated warehouse is similar in outward appearance to a general-purpose warehouse, it is different in one respect. Normally, there are no main aisles that run from end to end within the warehouse. There are cross aisles that connect the carloading and truckloading platforms. Door openings off these cross aisles permit access by MHE to the refrigerated storage areas.

(3) Flammable Storage Warehouse. A flammable storage warehouse is used for the storage of highly combustible materials, such as paint and oils. Flammable warehouses are similar in appearance to general-purpose warehouses. They are divided into one or more compartments, each separated by a firewall, which has a 4-hour fire resistance rating. Additionally, an automatic deluge sprinkler system and an alarm reporting system is used for fire protection.

(4) Igloo. An igloo is used for the storage of ammunition and high explosives. It is generally constructed of masonry with an arched roof covered with earth and has doors on only one end. The arched roof of the typical igloo

limits the storage height of the stored material. This construction configuration is, however, a safety feature. In the event of an explosion, the highest point of the arch, being the weakest, would collapse first, canalizing the explosive force upward, thereby lessening the lateral damage. Although they are not mechanically heated, the temperature in igloos is maintained from 40 to 45 degrees Fahrenheit in winter and from 60 to 70 degrees Fahrenheit in summer by means of a special ventilation system. Due to the nature of items stored and for safety purposes, igloos are widely scattered in comparatively isolated areas. Because of the construction features of an igloo, the type of MHE used is often limited.

(5) **Shed.** A shed, which is a roofed structure without complete sidewalls, is used for storage of materials that require maximum ventilation or which do not require complete protection from the weather. A storage shed is a compromise between open storage and warehouse storage. It offers more protection than open storage but less than warehouse storage. Shed space is typically used for materiel not appreciably affected by moisture, large or heavy equipment (e.g., vehicles) which cannot be stored physically in warehouse space, and items in weather protective containers.

(6) **Dry Tank.** A dry tank is used for long-term storage and is constructed of steel and has a concrete floor. Vehicles are typical of the items stored in a dry tank. There are no operating aisles inside the tank for MHE and no carloading and truckloading platforms on the outside. A dry tank may be a temperature-controlled, dehumidified, and sealed unit. After materiel are placed in the tank, it is then sealed. The only entry into the tank is through a portal which permits entry of one person. If materiel are to be placed into the tank or removed, a panel must be unbolted and removed.

(7) **Above-Ground Magazine.** An above-ground magazine is designed for storage of ammunition and explosives. It is constructed with a roof, sidewalls, and endwalls, and is built of fireproof materials. It is well ventilated to

lessen the danger of an explosion and is widely separated from other magazines to minimize the destructiveness of an explosion. A typical magazine has a carloading platform that runs the entire length of the building. Normally, there are no main aisles running the length of the building, but there are aisles that run from the front (carloading platform side) of building to the back.

(8) **Dehumidified Warehouse.** When properly sealed and conditioned, almost any type of warehouse may be dehumidified. In actual practice, the general warehouse is the structure most often converted for dehumidified storage. Dehumidification is the most economical and efficient method of preservation for many classes of items. The number of dehumidified warehouses required at a distribution center depends upon the nature of the materials to be stored and will vary with different installations.

c. **Open Storage.** Open storage is used for the storage of those items that are not readily susceptible to damage by adverse weather conditions. It is also used for storage of items, which due to their size or weight, cannot be placed in covered storage. Supplies stored in open storage areas are sometimes covered with a tarpaulin which affords adequate protection for certain types of supplies. There are two types of open storage space: improved and unimproved.

(1) **Improved open storage space** is an open area that has been graded, drained, and hard surfaced or prepared with a topping of some suitable material in order to permit effective materiel handling operations.

(2) **Unimproved open storage space** is an open area that has not been graded and surfaced for storage purposes. This method of storage is comparatively inexpensive to maintain. The restriction on the use of MHE is the chief drawback to open unimproved storage. In areas of wide-ranging temperatures, especially after ground freezing and thawing

have occurred, the stored materiel may be difficult to retrieve.

7. Acquisition of Additional Storage Facilities.

a. Optimum utilization and common use is made of existing DoD storage facilities to help minimize overall storage and distribution costs. Storage facilities retained in standby for mobilization are made available and utilized in the most efficient manner during peacetime. Use of facilities of any DoD Component are considered before establishing or expansion of storage facilities.

b. When DoD storage facilities are not available to meet requirements, additional facilities may be acquired by which of several methods is most feasible and economical. These include: arranging for use of facilities of other federal agencies; using commercial warehousing services under the DoD Commercial Warehouse Service Plan; leasing non-Government owned facilities; purchasing facilities; and constructing new facilities. These options are particularly important during cases of emergency or periods of rapid mobilization when additional space is required on short notice.

8. Space Requirements.

a. General. Storage space is a basic resource of the storage operation. Economy depends upon the optimum utilization of this space, and the proper arrangement of operations incident to the receipt, storage, and issue of materiel. Space economy can be obtained only by thorough planning for the use of space. Space requirements are not computed on an "after the fact" basis. To put it another way, inventories are not first stored and then computations developed indicating that "x" amount of storage space is required.

b. Considerations in Space Requirement Computations. There are many factors which must be considered in computing storage space

requirements and availability. These factors must be recognized for their applicability by all concerned with computing space requirements or meeting occupancy standards. The following are key factors:

(1) Quantity of Inventory. Although many elements contribute to the computation of storage space requirements, quantity is the basic element or conversion factor. From this, space requirements can be computed through application of dollar values and/or cubic footage of supplies.

(2) Characteristics of Storage Facility. Since storage space is three dimensional, facility characteristics must be carefully analyzed. Limitations such as stacking height, floor capacity, structural clearance, and other obstacles must be recognized.

(3) Equipment Capabilities. Use of potential warehouse storage height may be restricted by the lack of equipment capabilities to achieve maximum vertical utilization. Forklifts too large for the tasks at hand require aisle space wider than otherwise necessary.

(4) Commodity Characteristics. The type of commodity being stored must be considered in determining whether the gross cube available can be filled. For example, the maximum stacking height potential is influenced by the characteristics of the materiel or its packaging.

(5) Aisles. Preplanning of aisle positioning on layouts must be done prior to placement of materiel. Allowing the aisle layout to take shape as materiel are placed in stock may result in placing materiel in inaccessible locations and loss of space. **Aisle widths are determined by the size of the materiel handling equipment needed in the storage facility.** Aisles should only be wide enough to provide maneuvering room for the materiel handling equipment actually used for the stock storage and selection actions.

c. Total Warehouse Storage Space.

Space is measured in both vertical and horizontal dimensions. Computation of space requirements use cubic feet and/or square feet as conversion factors in relating materiel to space. The storage space within a warehouse includes:

- (1) Gross storage space -- Gross area, regardless of its location or the purpose for which the space was designed or designated, which is assigned or used for any operation concerning storage or the support of storage functions.
- (2) Net storage space -- Gross space for storage operations minus space used for storage support, aisles, and structural loss.
- (3) Storage support space -- Area used for packing, preservation, receiving, shipping, inspection, administrative offices, rest areas, tool rooms, etc.
- (4) Aisles -- Any passageway within a storage area; e.g., fire, personnel, main, and cross aisles.
- (5) Structural Loss -- Space not usable for storage because of obstructions caused by physical characteristics of the facility such as posts, ramps, door clearances, and installed equipment.

9. Space Occupancy and Utilization.

a. Storage Space Management Report (DD Form 805). DoD installations are required to prepare an annual or semi-annual report of utilization and occupancy of storage space. These reports are submitted through the DoD Component headquarters to the Secretary of Defense. The report provides for evaluation of space use against established storage management objectives. It provides a basis for management of storage space for purposes of allocation, assignment, and control through evaluation of utilization and occupancy performance and to provide background

information on which to base responses to inquiries from higher authority.

b. General. Storage space is limited and expensive to build and maintain. Space assignment and utilization at a distribution center is the responsibility of the distribution center commander. To effect the most economical utilization of storage space, assignment of space should be based on approved space management methods and forecasted requirements.

c. Occupancy of Gross Storage Space. How much of the area in the distribution center's storage facilities should actually be used for storage of materiel? This will vary from installation to installation depending upon factors such as building characteristics, mission, or type of items stored. An accepted standard is that 65 percent of the available gross space should be available for storage of supplies. This leaves approximately 35 percent of the gross space that can be used for offices, restrooms, aisles, and other necessary working spaces.

d. Occupancy of Net Storage Space. An accepted standard for the occupancy level of covered space for general supplies is 85 percent of net storage space available. In any storage operation, it is desirable to have "elbow room" available for operational flexibility. Sufficient elbow room should be available to minimize the continuous necessity for relocation of stocks to "fit" additional receipts into the storage pattern. This extra room is also needed to facilitate access to and withdrawal of stocks. Fifteen percent of the net available space is considered an adequate allowance for elbow room for general supplies.

e. Space Utilization in Storage Support. Not all space in a storage area can be allocated to materiel storage. However, the diversion of space from actual storage to storage support functions should be held to the minimum consistent with good operating practices. Considerations in computation of space requirements for storage support activities include:

(1) The requirements for space for storage support functions are greatly influenced by the mission responsibilities of the particular activity. As an example, net storage space operated does not necessarily have an absolute bearing on the amount of space allocated to packing or preservation. Detailed evaluation of the particular operating circumstances is, therefore, necessary before accurate computation can be accomplished.

(2) It is impractical to establish firm ratios of space allotted for storage support purposes on the basis of personnel employed or gross area operated. However, storage management personnel should frequently appraise actual support requirements to assure that valuable space is not allocated to these functions in excess of minimum requirements.

(3) Computation of space requirements for support functions can be developed, in great part, through review of both past and current requirement experience. When projecting future needs, give consideration to possible mission changes, workload fluctuations, personnel variations, and improved techniques which would alter requirements.

10. Space Planning and Layout Factors.

Since storage space is the basic resource of the distribution center's storage mission, critical planning must be accomplished if space is to be used properly. It must be realized that before we can actually store materials, there must be planning -- where and how we are going to store. Two prime factors influence the storage manager's use and layout of available space: **commodity factors** -- the characteristics of the materials to be stored -- and **capacity factors** -- the characteristics of the storage area. These factors cannot be separated; one influences the other all throughout the storage operation.

11. Commodity Factors.

a. General. Commodity factors are characteristics of the supplies being stored. The supplies handled by the average distribution

center consist of tens of thousands of items of different weight, size, shape, perishability, and crushability. These supplies are packaged various ways within different types of containers. Most items of general supply are of such a nature that special handling or storage methods are not necessary other than consideration of similarity, popularity, and size. However, there are some items which have special handling needs or require special storage facilities.

b. Item Similarity. Items with similar handling requirements should be stored together when feasible. This facilitates storage and issue and contributes to effective care of supplies. By way of illustration, consider the difference in characteristics between plumbing hardware, drums of chemicals, and electrostatic-sensitive electronic components.

c. Item Popularity. Activity or popularity is an important factor in planning the storage layout for materiel. The fastest moving bulk stocks should be planned for storage in areas that are quickly and easily accessible. This reduces travel of materials handling equipment and stock selection personnel. Loose issue areas should be located adjacent to packing and processing areas. Fast moving bin stocks should be easily accessible to expedite stock selection and replenishment actions. Items with the slowest turnover rate should be planned for placement in areas progressively farther from active stock or processing areas.

d. Item Size and Weight. The dimensions and weight of items affect the amount of storage space allotted, the location in which items are to be stored, and the type of storage aid used. For example, a 5-ton generator would be stored in a location that provides a balance between accessibility to required handling equipment and yet requires a minimum travel distance to receiving and shipping areas.

e. Item Quantity. The quantity of materiel on hand affects the amount of space required. It is frequently desirable to increase the amount of space assigned to an item in a single location in

order to eliminate the need for two locations. This may reduce effort and travel in replenishment actions for binnable items and reduce administrative effort required for maintenance of the location record system.

f. Hazardous. Some materials must be given special handling or storage to prevent a hazard to personnel and facilities. Some materials are not compatible with other materials, and are hazardous on contact with them. Hazardous commodities include those that are toxic, caustic, or flammable. Within DLAM 4145.12, there is a hazardous materials storage and handling criteria table that gives guidance on separation requirements, type of storage facilities needed, and handling procedures.

g. Classified, Sensitive, or Pilferable. Some materials require a high degree of protection and control due to statutory requirements or regulations. Classified items require protection in the interest of national security. Sensitive items include narcotics, precious metals, small arms, etc. Items subject to theft are considered pilferable.

h. Perishable and Deteriorative. Some materials have a limited storage life and care must be taken to assure that the oldest stock or that which has an earlier shelf life expiration date is issued first. Charts containing storage life data and temperature/humidity control are found in DLAM 4145.12.

12. Capacity Factors.

a. General. Capacity factors are characteristics of the storage facility. They affect the amount of space that can actually be occupied, for what purpose that space can be used, where the items will be located, and the items that are suitable to be stored there. Older types of building construction found in many distribution centers are not fully conducive to good storage. Although most have suitable features for storage in general, some aspects inhibit optimum storage capacity.

b. The storage planner must consider the effects of location and width of warehouse doors, intensity of lighting and location of lighting fixtures, availability and size of overhead cranes and elevators, location of columns or pillars, maximum floor load, ceiling heights, overhead obstructions, sprinkler systems, fire valves and extinguishers, and heating systems.

c. Pillars and columns are necessary as roof supports and cannot be removed; yet they reduce the amount of usable storage space as well as interfere in the placement of storage aids and pallets. Although the light and air admitted by windows do improve working conditions, from a purely operational standpoint, they are a handicap. Floor load limits can cause a great waste in cubic feet of space; however, if these limits are not considered, a safety hazard is created.

13. Methods of Storage.

a. The manner in which material is actually held in storage is generally categorized as one of three methods: heavy bulk, medium bulk, and bin storage. The method of storage selected for a particular item results from the proper application of the principles and factors previously discussed. Frequently an item of stock will be stored by more than one method, reflecting the volume of stock usually on hand and the issue pattern for that item.

b. **Heavy Bulk Storage.** This is storage of any large quantity of supplies usually in the original unopened containers; or storage of liquids or solids such as coal, lumber, petroleum products, or ores in tanks or piles. Material in containers is usually stored on pallets, the bottom pallet is placed directly on the floor and additional pallets commonly stacked one on top of the other without the use of storage aids. Bulk storage is suitable for storing large quantities of material for issue in large lots, bulky items having high demand, and **backup stock for bin or rack storage replenishment.**

c. **Medium Bulk Storage.** This method of storage employs the use of metal pallet racks, wherein the pallet is placed into the rack opening and is supported by the rack. The number of stacking levels is determined by the ceiling height, the reach capability of the materials handling equipment, and the floor load limit. Medium bulk storage is employed for single pallet quantities or broken lots, opened cartons holding more than binnable amounts, backup stock for bin storage, and items or containers that are not self-stackable. What is achieved is a stage of storage between bin storage and heavy bulk storage.

d. **Bin Storage.** In this method of storage, small quantities of an item are stored in various size open-front bins, drawers, or shelf boxes. Here, the item is usually found in its smallest unit of issue; e.g., each, package, etc. or when the total amount of stock normally on hand is of a small volume.

14. Bin and Bulk Operations.

a. The vast majority of items in the DoD inventory are binnable. In the planning and selection of items for storage in bin areas, the assignment of a specific item within the bin section is governed by the principles and factors previously discussed. Fast moving binnable items, whether large or small, must be assigned space adequate to minimize replenishment frequency, time, and effort. In some cases, the volume of issues or the size of the item is so small that the total quantity may be binned in one location. On the other hand, binning only a few days supply of a bulky item may result in inefficient use of bin space.

b. There are many factors favoring issues from bin locations. The repetitive issue of small quantities of binnable-type items from bulk storage can rarely be justified. Proper use of bins will minimize the inventory and security problems found where there are broken cases of binnable-type items in bulk storage locations.

c. The bin replenishment system must provide for systematic replenishment to maintain stocks at the desired level based upon issue workload experience. In automated systems where the computer keeps track of the quantity in each location, initiation of bin replenishment action is done automatically. Where the computer does not maintain quantity by location, the warehouseworker selecting the stock carries the responsibility for initiating a bin replenishment request. Bin replenishment stock is normally obtained from medium and heavy bulk storage.

d. Pallet placement and withdrawal patterns are matters for continuing attention due to their potential for causing poor space utilization. Careless withdrawal of stock from bulk areas can degrade even the most carefully designed layout. "Honeycombing" is the storing or withdrawing of stocks in a manner which results in vacant space that is not usable for storage of other items. Withdrawals of pallets across the whole front of the lot merely widens the aisle and does not create additional space for the storage of new items. Poor palletization practices cause honeycombing by creating voids within the arrangement of materiel on the pallets and by space loss between stacks from excessive overhang.

15. Floor Plans, Layouts, and Planographs.

a. **Floor Plan.** The storage area floor plan is the starting point for planning the effective use of space. It serves as the basis for developing the storage area layouts and planographs. The floor plan of the building shows columns, stair wells, elevator shafts, offices, washrooms, doors, and other structural features.

b. **Layout.** Using the principles of space requirements determination and layout planning previously discussed, effective storage area layouts can then be developed. A preliminary storage layout is drawn on the floor plan. The location of aisles, areas for bin and bulk, and storage operating areas are entered. The direction of flow and storage is established and

entered. Quantities of bin sections and various types of racks are determined. The requirement for storage space, by type, amount, and position is calculated using estimated quantities, sizes, characteristics, and demand frequency of the items.

c. **Flexibility.** Changes in the types of materials handled or the average quantities in stock requires periodic changes of layout. The storage manager must be aware of the need for changes and when they occur, alter the layout, and undertake a rewarehousing effort if a change will increase operational efficiency.

d. **Planographs.** Up-to-date and well maintained planographs are the heart of a continuous program of space planning, utilization, and control. Detailed planographs depicting specific storage arrangements are developed from the approved layouts. The planograph is a scale drawing of the actual layout of a storage structure or outside storage area. It accurately portrays the exact manner in which the gross storage space is subdivided, showing the storage areas by method of storage, shipping and receiving areas, aisles, restrooms, offices, and structural features. The planograph also serves as the basis for preparing the storage space status report and establishing and maintaining the stock locator system.

16. Materials Handling. Materials handling involves the movement of materials and supplies from one place to another. The basic principles of materials handling require that:

a. Packing techniques such as palletization and containerization must be standardized and coordinated with the design and procurement of MHE so equipment at a storage location can handle all supplies delivered. Furthermore, the design of aisles and stacks in all types of storage facilities must be considered prior to procuring MHE. Platforms, ramps, and intransit storage facilities must be compatible with both the MHE and the unloading characteristics of the transportation modes.

b. The flow patterns of movement of supplies should be designed and periodically reevaluated to allow for maximum utilization of MHE. Idle equipment is often an indication of inefficient flow patterns. A straight line between pickup and delivery points is the shortest distance between the two points, a consideration which is sometimes overlooked. Loading, unloading, and turnaround space is required. One of the basic objectives of materials handling is to organize handling so that the number and distances of moves are minimized.

c. Each piece of equipment should do a variety of jobs. However, with the many sizes, weights, and types of packaging, there must be a number of types of equipment available in each installation. Consequently, careful management is required to optimize their use. Materials handling must be planned and organized so that the most efficient piece of equipment is available for each moving or stacking operation. For example, a forklift might be appropriate to move pallets a short distance, but a tractor-trailer train would be far more efficient for movements over longer distances.

d. Advance planning of materials handling methods and equipment must be performed concurrently with other planning activities and undertakings. Some of the factors requiring advance planning include the need for protection against weather and breakage, the possibility of using unitized loads, the opportunities for standardizing equipment and methods, and the possibility of combining materials handling methods. Safety is always a prime planning consideration.

e. The use of physical labor in the handling of materials in storage must be kept to a minimum. The long-term cost of using manual labor makes it imperative that logistics managers investigate other material handling alternatives. Consequently, planning for procurement, operation, and maintenance of MHE is essential to good storage operations.

17. Care of Supplies in Storage.

a. A program for the care of supplies in storage (COSIS) to assure a ready-for-issue condition is an essential task and integral part of storage management. Inspection of materiel in storage is an extremely important step in maintaining materiel quality. In many instances, long periods of time elapse from the time of receipt of materiel by the storage activity until ultimate issue and shipment to the user. During this interim period, stored materiel must be systematically inspected to detect materiel degradation.

b. The distinction between COSIS-related actions and other actions that might otherwise fall into the broad category of care given materiel in storage is that COSIS concerns itself with the in-storage inspection, minor repair, testing, exercising of materiel, and the preservation and packing aspects of these efforts. COSIS excludes those actions that fall under the area of general warehouse care and maintenance.

c. Loss of materiel quality comes from deterioration, corrosion, damage, and other deficiencies caused by improper storage methods, extended periods of storage, or by the inherent deterioration characteristics of the materiel itself. The use of quality control techniques and storage serviceability standards is the foundation of a COSIS program.

d. Minor deficiencies must be detected before they become of major significance, thus providing for corrective actions before the materiel becomes unserviceable or unusable. In this regard, a program of cyclic inspection identifies those stocks which require servicing or corrective action to assure that materiel is maintained in a serviceable condition. Further, it identifies those assets which require condition reclassification to a lesser degree of serviceability.

e. Stored materiel is inspected at intervals indicated by the type of item, shelf-life code, storage serviceability standards, type of storage

afforded the materiel, and anticipated length of storage. Quantitative data generated by the cyclic inspection system are thoroughly analyzed and summarized to assist in the elimination of the causes for deficiencies.

f. Objectives. Major objectives of a COSIS program:

(1) Determine the true condition of materiel in storage.

(2) Ensure that the true condition of the materiel is properly recorded.

(3) Provide adequate protection while materiel is in storage to prevent deterioration.

(4) Arrest all forms of deterioration that will affect the use of the materiel.

(5) Restore materiel to a serviceable condition.

18. Receiving and Issue Functions within Storage Operations.

a. One of the major functions within the storage operation is receipt storage. Receiving in the storage operation concerns the manner in which supplies are brought into the storage facility following receipt inspection and subsequently stowed in the stock location. Receipt inspection activities are accomplished by the distribution center's receiving element, whereas the stowing activities are completed by the storage element. The details of receipt storage are dependent upon commodity and capacity factors. Storage planning begins when information is received that identifies an incoming shipment. Storage planning requires the storage manager to plan ahead based on advanced shipment arrival notices, initiate action to obtain unusual equipment and labor requirements, and assign vacant space to meet the demand brought about by incoming stocks. Because arrival of new receipts at the distribution center is a factor over which distribution center managers have little control,

the day-to-day receipt workload fluctuates more than most other activities. As a consequence, a high degree of coordination between the storage and receiving elements is necessary.

b. The issue function within the storage operation deals with selecting stocks from storage and readying them for shipment. The accuracy with which supplies are received and placed into storage, the care given to the stocks while in storage, and the attention to housekeeping functions all play a role in the efficiency with which the issue function is performed. Storage planning for the issue function begins with the materiel release order and continues through the selection of stocks, packing, marking, and unitizing. Outgoing shipments must be checked to ensure proper selection, accurate documentation, adequate packaging, and correct labeling. All of these activities are performed by personnel assigned to the storage operation.

19. Summary.

a. Space is a basic resource of the distribution center in accomplishing its storage mission. Economy of this resource depends upon the optimum use of space. Space planning

is necessary to achieve the most effective receipt, storage, and issue of materiel for logistics support of the military forces. Economic and strategic reasons dictate, in some cases, the need for large inventories of materiel in storage. A properly managed storage operation results in many measurable benefits. Numerous different types of storage structures are found in the DoD, each having a specified use. To determine space requirements, meet utilization standards, and achieve the most efficient storage layout, the characteristics of the materiel and the storage facilities must both be considered.

b. Several methods of storage are used, reflecting the type, volume, and issue pattern of the materiel stored. Bin replenishment is an important area for attention because of its impact on issue performance. Planographs give a graphic picture of the storage area layout and the types of storage methods being used. The principles of materiel handling all work toward achieving the most rapid movement of materiel with the least effort. A program for care of supplies in storage is essential to keep the materiel stored in serviceable condition. Receiving and issue functions are an integral part of the storage operation.

OUTLINE FOR NOTETAKING

STORAGE MANAGEMENT

I. Storage in the Distribution System.

A. Strategic/Tactical Reasons.

B. Economic Reasons.

II. Storage Objectives.

A. Maximum Use of Space.

B. Savings of Time, Labor, and Equipment.

C. Rapid Accessibility.

D. Protection.

III. Storage Facilities.

A. Covered Storage.

1. General Purpose.

2. Special Purpose.

B. Open Storage.

1. Improved.

OUTLINE FOR NOTETAKING (Continued)

STORAGE MANAGEMENT

2. Unimproved.

IV. Additional Storage Facilities.

V. Space Requirements.

A. Considerations.

B. Space Measurement.

VI. Space Occupancy and Utilization.

A. Storage Space Management Report.

B. Gross Space.

C. Net Space.

D. Support Space.

VII. Commodity Factors.

VIII. Capacity Factors.

IX. Methods of Storage.

A. Heavy Bulk.

B. Medium Bulk.

OUTLINE FOR NOTETAKING (Continued)

STORAGE MANAGEMENT

C. Bin.

X. Bin and Bulk Operations.

A. Bin Replenishment.

B. Honeycombing.

XI. Floor Plans, Layouts, and Planographs.

A. Floor Plan.

B. Layout.

C. Planograph.

XII. Materials Handling.

A. Standardization and Compatibility.

B. Flow Patterns.

C. Equipment.

D. Planning.

E. Labor.

XIII. Care of Supplies in Storage (COSIS).

OUTLINE FOR NOTETAKING (Continued)

STORAGE MANAGEMENT

A. Definition.

B. Why Care is Needed.

C. Objectives.

XIV. Receiving and Issue Functions.

A. Receiving.

B. Issue.

STUDY QUESTIONS

1. Why is storage such an important element of the distribution system?
2. Describe the two categories of storage space found at a distribution center.
3. What is the purpose of the Storage Space Management Report?
4. What is meant by "elbow room?"
5. Define commodity and capacity factors. Give examples of each.
6. Describe the features of heavy bulk, medium bulk, and bin storage.
7. What is bin replenishment? What effect does it have on issue processing?
8. What is a planograph? Name two of its uses.
9. What is COSIS? Why is it important?
10. What is the relationship between storage operations and the receiving and issue functions?

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