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**DEPARTMENTS OF THE ARMY,
NAVY, AND AIR FORCE, AND THE
DEFENSE LOGISTICS AGENCY**

PACKAGING OF MATERIEL

PACKING

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INTRODUCTION

PURPOSE AND SCOPE

PURPOSE

This publication contains information on the fundamental principles and approved methods and techniques used in the protection of military supplies and equipment against deterioration and damage during shipment and storage. It is published as an official document for use in operations and in the training of military and civilian personnel from all segments of the Department of Defense (DOD) and supporting agencies, as well as for interested industrial personnel. It contains information based on specifications, standards, and other pertinent documents, current as of the date of preparation and coordination of the publication.

NOTE

For Air Force use, the publication is non-directive in nature.

SCOPE

This manual emphasizes the importance of packing of military supplies and equipment. It contains detailed information concerning the requirements to accomplish packing operations. The requirements include use of exterior shipping containers; the assembling of items or packs into the container; anchoring, blocking, bracing, and cushioning of items or packages within the container; weatherproofing; strapping of containers; the testing of exterior packs; palletization and unitization of loads; parcel post; and related subject matter. General exterior marking in accordance with MIL-STD-129 is discussed.

CHANGES AND PROVISIONS

Changes or revisions to this manual are due to major changes in packing concepts, policies and doctrine, and revision of specifications and other official publications, will be made on a continuing basis, as required. Information contained herein is current as of June 1996.

Users are encouraged to submit recommended changes or comments to improve this manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications and Blank Forms) or appropriate service form and forwarded direct to Dean, U.S. Army Ordnance School of Military Packaging Technology, ATTN: ATSL-MPT, 360 Lanyard Road, Aberdeen Proving Ground, MD 21005-5003.

OBJECTIVES OF MILITARY PACKAGING

The objectives for achieving uniform packing of items of military supply are to--

- Insure optimum life, utility and performance of materiel through prevention of deterioration or damage.
- Support the materiel readiness posture of DOD.

- Provide for efficient receipt, storage, inventory, transfer and issue of materiel.
- Assure that marking requirements are kept at the minimum necessary for effective identification, handling, shipment and storage.
- Effect economies by requiring the use of packs which yield lowest overall cost to the total DOD distribution system consistent with known or anticipated shipment handling and storage conditions. Considerations will include--
 - o Minimization of materials, methods of preservation, and documentation.
 - o Accomplishment with optimum amount of automated operations.
 - o Minimum weight and cube.
 - o Use of modular containers.
 - o Handling by unitized load configuration.
 - o Use of containerization.
 - o Exploitation of new materials, methods, and techniques.
 - o Disposability of packaging materials.

HAZARDS ENCOUNTERED IN TRANSPORTATION, HANDLING, AND STORAGE

Military supplies and equipment must be protected against pilferage and damage due to force and exposure, not only until they reach their ultimate destination, but until the items are placed into actual use or service. Force and exposure will reduce the useful lifespan of the item or cause the item to be damaged beyond repair. The objective of packing is to extend the lifespan of the item so that depreciation starts, not when it leaves the manufacturing plant, but when it is placed into service.

Force

Damage may result from hazardous forces encountered in transportation, handling, and storage (figure 1). Transportation hazards involve forces encountered through rail, truck, boat, or air shipments. The damage caused can result from abrupt starts, stops, vibration, and jolting.

Handling hazards involve those damaging forces received through loading, unloading, and handling during storage operations. Examples of handling where damage often occurs are--

- Manual handling--dropping and puncture.
- Forklift truck handling--dropping and puncture.
- Cargo nets--dropping, crushing, and wracking.
- Grab hooks--crushing and puncture.
- Slings--crushing, dropping, and wracking.
- Conveyers--jarring, smashing, and dropping.

Storage hazards involve those forces resulting from the crushing effect of superimposed loads through stacking.

Exposure

Exposure to the different climatic conditions and weather hazards, such as high humidity, rain, salt spray, extreme cold, dry intense heat, and the cycling of these weather conditions, will tend to accelerate the breakdown or deterioration of unprotected items.

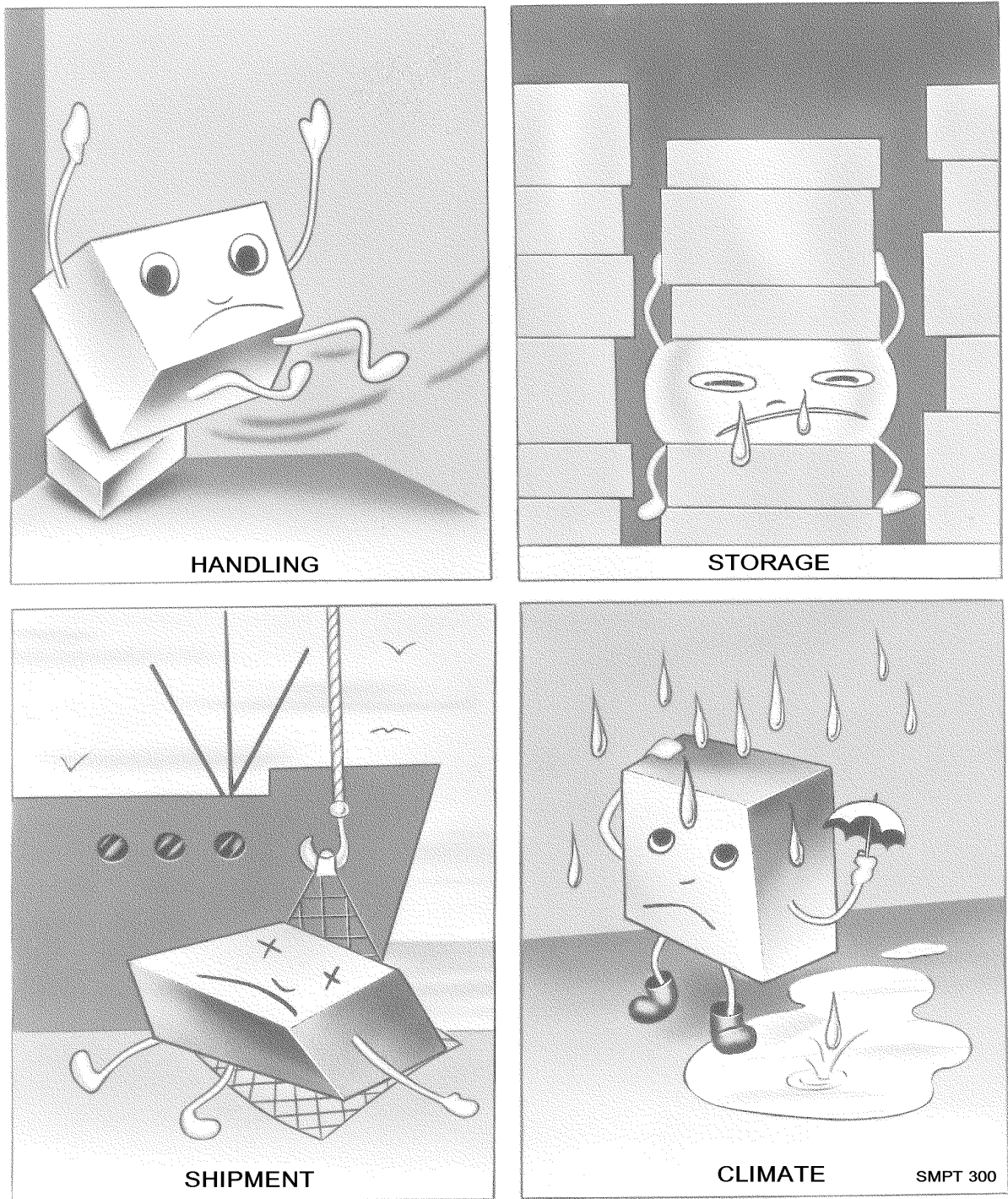


Figure 1. Hazardous forces encountered in transportation handling, and storage.

Pilferage

Theft of military supplies and equipment while in transit or storage is a significant problem for the military. Small items of high value are especially vulnerable to pilferage and should be protected as much as possible through packing techniques.

Countermeasures To Hazards Of Pack

Items which are packed properly will resist the damaging effects of force and exposure. Force is counteracted by--

- Using rigid shipping containers.
- Immobilizing the item within the container through anchoring, blocking, and bracing.
- Damping forces through the use of cushioning materials and devices.
- Reinforcing shipping containers with metal and nonmetallic strapping or reinforcement tape as appropriate.

Exposure is counteracted by the use of--

- Weather-resistant shipping containers.
- Waterproof barrier materials in various applications.

NECESSITY FOR A PACKAGING POLICY

To attain economy, efficiency, and uniformity in packing, and to provide a uniform procedure in connection with procurement, the services and agencies of the Department of Defense must have a common packing policy. This is provided by the Department of Defense (DOD) 4140.1-R, Materiel Management Regulation.

MILITARY REGULATIONS

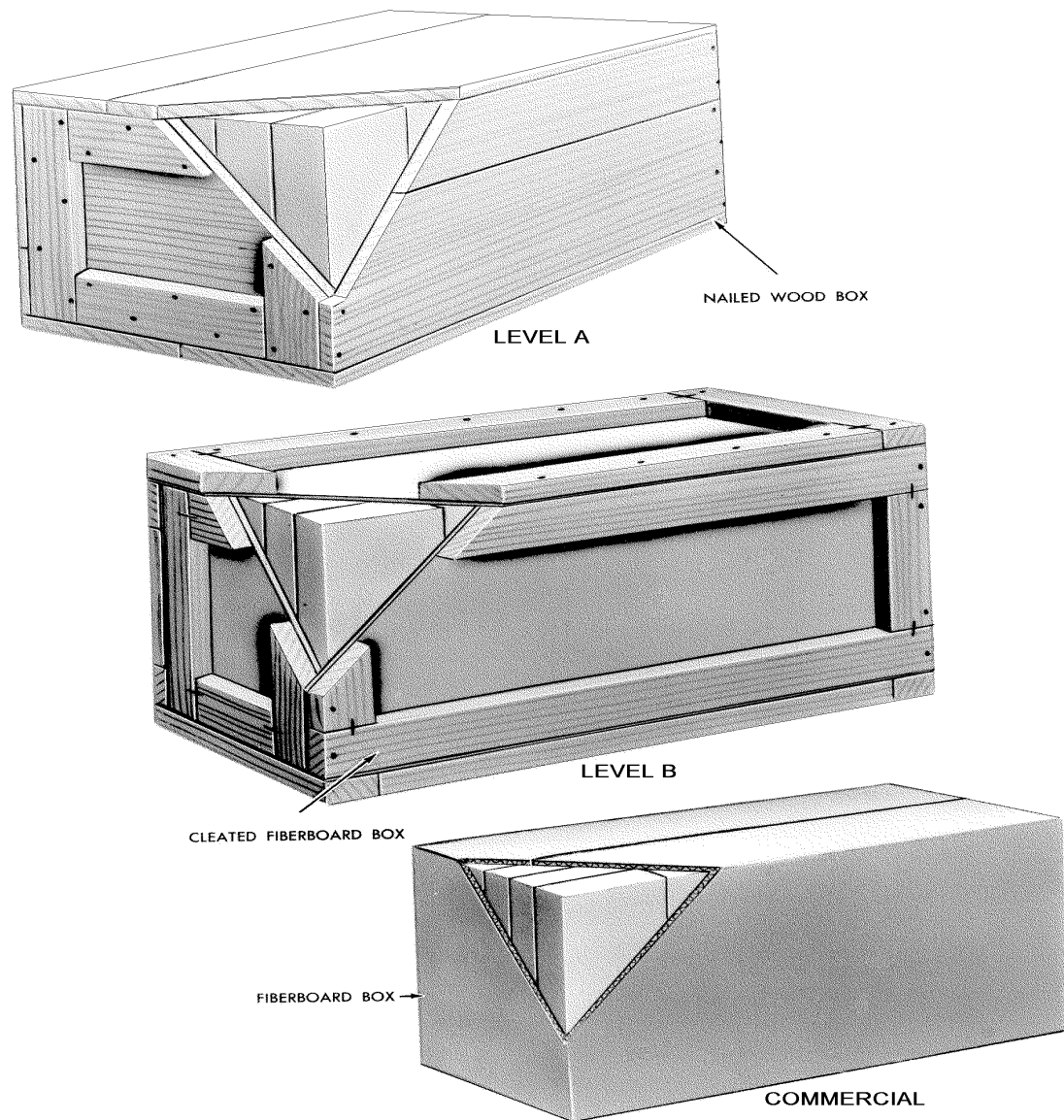
The Joint Regulation AR 700-15/NAVSUPINST 4030.28C/AFJMAN 24-204/MCO 4030.33D/DLAD4145.7, applies to all Department of Defense components (Army, Air Force, Navy, Marine Corps, and the Defense Logistics Agency) responsible for packaging an item throughout its life cycle.

This regulation on the packaging of materiel implements DOD 4140. 1-R and covers packaging requirements, American Society for Testing and Materials Standards (ASTM) specifications, levels of protection along with policies and procedures for Performance Oriented Packaging (POP) and the protection of electrostatic discharge sensitive items.

MILITARY PACKAGING LEVELS OF PROTECTION

Concept of Military Levels of Protection

In regard to requirements for packing, the military services for many years relied heavily on the terms "domestic" and "overseas". Experience proved that for military purposes, these words were vague generalities with no clear-cut meaning to them. Suppliers were often perplexed when confronted with overseas requirements for items destined for domestic installations. It was not apparent to them that the domestic destinations were merely initial receiving points for projected overseas shipments, or that storage and handling conditions were severe enough to justify an overseas type of packing regardless of destination. To permit the military services to state their requirements more objectively, the concept of levels of protection was adopted. As defined in MIL-STD-2073-1C, levels of protection are a means of specifying the level of military preservation and packing that a given item requires to assure that it is not degraded during shipment and storage (see figure 2). Specific levels of protection are as follows:



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Figure 2. Examples of protection.

- **Military level of preservation.** Preservation designed to protect an item during shipment, handling, indeterminate storage, and distribution to consignees worldwide.
- **Military levels of packing.**
 - o **Level A.** Protection required to meet the most severe worldwide shipment, handling, and storage conditions. Level A pack must, in tandem with the applied preservation, be capable of protecting material from the effects of direct exposure to extremes of climate, terrain, operational and transportation environments. Examples of situations which indicate a need for use of a Level A pack are: War Reserve Material, mobilization, strategic and theater deployment and employment, open storage, and deck loading. Examples of containers used for Level A packing

requirements include, but are not limited to, overseas type wood boxes and plastic and metal reusable containers.

- o **Level B.** Protection required to meet moderate worldwide shipment, handling, and storage conditions. Level B pack must, in tandem with the applied preservation, be capable of protecting material not directly exposed to extremes of climate, terrain, and operational transportation environments. Examples of situations which indicate a need for use of a Level B pack are: security assistance (e.g., Foreign Military Sales (FMS)) and containerized overseas shipments. Examples of containers used for Level B packing requirements include, but are not limited to, domestic wood crates, weather-resistant fiberboard containers, fast pack containers, weather-resistant fiber drums, and weather-resistant paper and multi-wall shipping sacks.

Commercial Packaging. Commercial packaging is defined as the materials and methods used by the supplier to meet the requirements of the distribution systems serving both DOD and commercial consumers. The requirements of MIL-STD-2073-1C shall only be applied to the packaging of items that are expected to enter the military distribution system. Commercial packaging is to be used to the maximum extent possible for all other items. Items not going into stock shall be packaged in accordance with ASTM D 3951, Standard Practice for Commercial Packaging.

Commercial packaging will be acceptable for any level of protection when the technical design of the package meets all conditions of the level of protection specified. It will be marked to the level it meets. Use of commercial packaging is contingent upon no increase in packaging changes, size, weight, or delay in delivery.

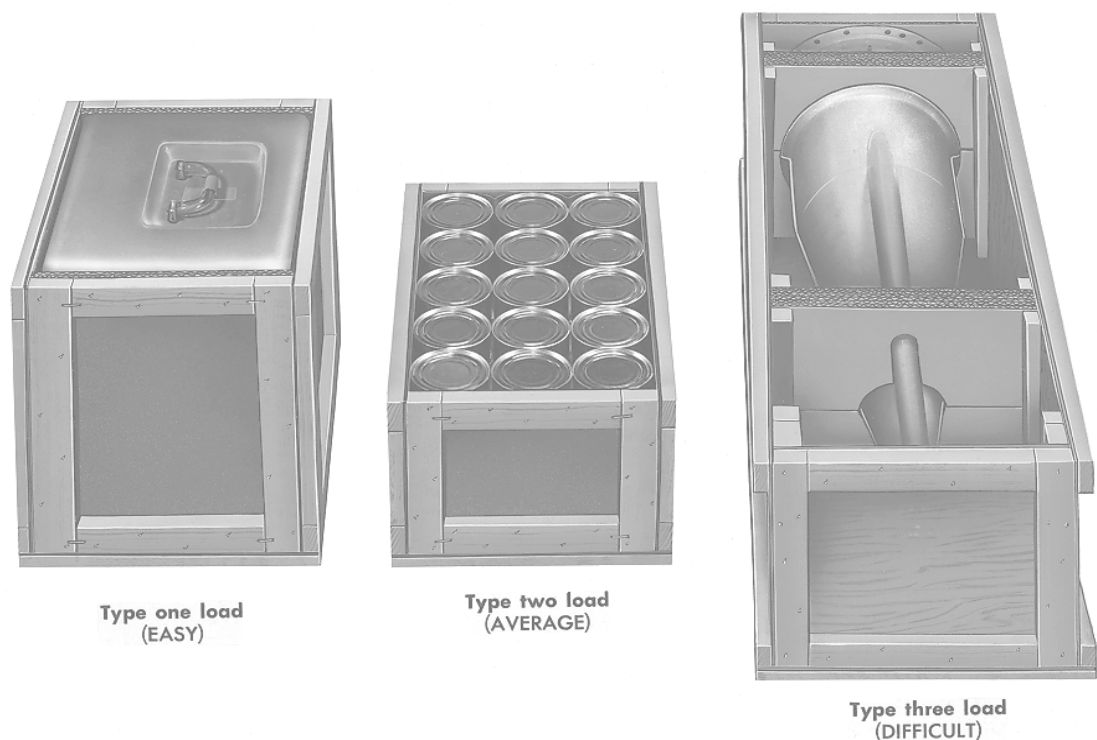
Bulk practices used in interplant and intraplant movements or shipments to jobbers are not acceptable unless they are the usual trade practices for individual commodities such as coal, textiles, petroleum, and subsistence.

The packaging details will be incorporated into standardization and acquisition documents when applicable.

NATO STANAG 4280, LEVELS OF REQUIREMENTS FOR PACKAGING

Participating nations agree to adopt the NATO levels of requirements - defined in this STANAG as the basis for negotiation for the procurement of packaged materiel between nations. In defining levels of requirements it is necessary to take into account: The characteristics of the environment and constraints imposed by the environment; the technical considerations to define package tests; the four levels of packaging used in NATO; and, it also shows comparison of these NATO levels against the nearest national packaging requirement.

Type of Load. The term "type of load" refers to the physical characteristics of the item, including the nature of the item as it contributes to the support of, or damage to the container. The same kind of container can be designed to provide adequate protection to various items by adjusting the constructional requirements. This may result in a light, medium, or heavyduty container, as necessary. The design of the shipping container to be used is influenced by the type of load. There are three types of loads: Type 1, Type 2 and Type 3. The types of loads will be mentioned under the various shipping containers and in section I (figure 3).



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Figure 3. Types of loads

Type 1 - easy load. The load is a single item or single interior container which provides complete and uniform support to all faces of the shipping container. Bulk practices used in interplant and intraplant movements or shipments to jobbers are not acceptable unless they are the usual trade practices for individual commodities such as coal, textiles, petroleum, and subsistence.

Type 2 - average load. The load is composed of more than one item or interior container which give some support to all faces of the shipping container. The contents are of moderate density and relatively sturdy. Some examples are goods in metal cans which are not packed in an interior container, bottles individually cushioned, and hardware in cartons.

Type 3 - Difficult load. The load gives little or no support to the shipping container. The contents can be extremely heavy, very fragile, very irregular in shape, bulk materials which are free to shift, and flow, or a combination of several of these factors. Some examples are rivets, bolts, and nuts, delicate instruments and machined parts and assemblies.

ECONOMY IN PACKING

The military concept of economy in packing is to obtain maximum output of adequately protected items at a minimum cost. Economy measures, consistent, with the degree of protection required by an item or package should be of prime concern to individuals engaged in the establishment of packing requirements, and to personnel in charge of, or performing packing

operations. Significant savings can be accomplished by reducing the tare weight, cubage, and packing cost of a commodity through proper reengineering of the unit and exterior containers, use of newly developed materials, and employment of alternate methods and techniques.

REFERENCES

Throughout this manual, packing materials, equipment, processes, methods, etc., are referred to by their common names together with the appropriate specification, standard, or other publication symbols. Copies of specifications and other documents required by activities of the Defense Logistics Agency, the Department of the Army, Navy, and Air Force, and the Marine Corps are obtained from supply sources through established channels. Copies of specifications, standards, and drawings required by contractors connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer. Military and Federal Specifications and Standards are available from: Standardization Document Order Desk, 700 Robbins Avenue, Building #4, Section D, Philadelphia PA 19111-5094. Information pamphlet titled "A Guide for the Private Industry" provides more detailed information and is available upon request.

CHAPTER 1

PACKING

GENERAL

PACKING OF GENERAL SUPPLIES

Some commodity items require preservation by procedures and materials described in FM 38-700/MCO P4030.31D/NAVSUP PUB 502/AFJPM 24-237/DLAI 4145.14, Packaging of Materiel – Preservation, which provide unit containers suitable for shipment without further packing. Other items may require further packing in containers suitable for shipment. This chapter relates to the packing of commodity items directly in shipping containers with whatever protection is required to prevent damage in shipment, handling and storage. The container alone cannot always provide full protection for military items. Items must be properly anchored, braced, blocked, or cushioned in the container to provide adequate protection. A container is often blamed for damage to its contents when the cushioning, blocking, or bracing are at fault (fig. 1-1). Every packing operation, including the final closure, strapping, and marking of the container, must be carefully planned and executed to ensure that the contents will arrive at its destination in a usable condition.

PACKAGING OF HAZARDOUS ARTICLES

Commodities classified as hazardous materials come within the scope of TITLE 49 Code of Federal Regulations which incorporates Department of Transportation Regulation for the Transportation of Explosives and other Hazardous Articles by all modes. International Shipments must be packaged in accordance with the International Air Transport Associations Dangerous Goods Regulation (IATA) and the International Maritime Organization Dangerous Goods Code (IMDG) codes. In addition, hazardous materials which are to be shipped via military aircraft must be packaged in accordance with the joint service manual AFJMAN 24-204/TM 38-250/NAVSUP PUB 505/MCO P4030.19/DLAM 4145.3, Preparing Hazardous Materials for Military Air Shipments.

SEQUENCE OF PACKING OPERATION

The general sequence of military packing is divided into a series of basic operations which may include some or all of the following steps, not necessarily in the order given below:

Determine the Packing Requirements

Knowing the item characteristics helps to determine the protection required and the best way to provide it through the use of an adequate container, suitable blocks, braces, and cushions, and appropriate barrier materials. This study will include consideration of the characteristics of the item, its size, shape, fragility, etc.; the types of loads (easy, average or difficult); the mode of transportation (rail, ship, truck, or aircraft); the storage facilities (covered or uncovered); the destination (domestic or overseas in the arctic, temperate, or tropic zones); and the levels of protection required.