

MIL-D-46845B(MI)  
31 August 1976  
~~SUPERSEDING~~  
MIL-D-46845A(MI)  
12 February 1968

## MILITARY SPECIFICATION

### DESIGN REQUIREMENTS FOR MISSILE WEAPON SYSTEMS PACKAGING AND PACKING

This specification is approved for use by US Army Missile Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 This specification establishes the design and development requirements for packaging and packing of the complete weapon system.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

#### SPECIFICATIONS

##### Military

MIL-P-116	Preservation, Methods of
* MIL-P-9024	Packaging, Handling and Transportability in System/Equipment Acquisition
MIL-P-14232	Parts, Equipment and Tools for Army Material, Packaging and Packing of
MIL-I-26860	Indicator, Humidity, Plug, Color Change
* MIL-P-45213	Preservation and Packing of Rocket and Missile Systems Equipment, for Shipment

FSC PACK

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## STANDARDS

Military

- |   |              |   |
|---|--------------|---|
| * | MIL-STD-1186 | Cushioning, Anchoring, Bracing, Blocking and Waterproofing, with Appropriate Test Methods |
|   | MS20003      | Indicator, Humidity, Card, Three Spot Impregnated Areas (Cobaltous Chloride)              |

(Copies of specifications, standards, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

## HANDBOOKS

Military

MIL-HDBK-304	Packaging Cushioning Design
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Army Materiel Command Pamphlet

AMCP 706-121	Packaging and Pack Engineering
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Army Regulation

AR 700-15	Preservation, Packaging and Packing
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Other

- |   |                                |                                 |
|---|--------------------------------|---------------------------------|
| * | U.S. Coast and Geodetic Survey | Magnetism of the Earth          |
| * | Department of Transportation   | Hazardous Materials Regulations |

- \* (Copies of specification, standards, drawing and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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### 3. REQUIREMENTS

3.1 Development of packaging and packing requirements. Technical packaging and packing requirements for Configuration End Items (CEI's), \* major or critical components, hazardous items and items (other than bulk type items) for which specification will be prepared shall, insofar as practicable, be developed concurrently with item development. Only packaging materials approved by the procuring activity will be used in the packaging engineering program, and every effort will be made to utilize a minimum of materials and methods.

3.2 Pilot model. When required, a pilot model of each special design container or newly developed pack (see 6.4) shall be prepared for inspection and test as specified in 4.2. Approved of the procuring activity is required for pilot pack tests.

\* 3.3 Design considerations. Specification MIL-P-14232, MIL-P-45213 \* and the design considerations of MIL-P-9024 shall be complied with in developing, preservation, packaging, packing and marking requirements for weapon system materiel. As far as practical, preservation methods and packaging and packing designs shall provide a reasonable balance between cost and performance. The preservation and packaging methods selected shall insure protection against natural and induced environments. A prerequisite to selection of preservation methods and package designs is the analysis of component characteristics and environments to which the equipment will be subjected during its life cycle. System military characteristics and logistics, operational and material support plans will provide basic guidance in performing the analysis. Retention of item reliability during storage and transportation shall be a major consideration during all phases of the life cycle of the item.

3.3.1 Levels of protection. Military levels of protection are described in terms of performance expected of the package and must be translated into specific technical requirements for individual items. Developed requirements shall meet, as economically as feasible, the criteria for military levels of protections as defined in AR 700-15.

3.3.2 Characteristics of components. Component characteristics shall be analysed, and their relationships to the degree of protection required shall be established prior to design of packaging.

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3.3.3 Transportation and storage conditions. The transportation and storage conditions for each item shall be determined as a prerequisite to and shall appropriately be incorporated in package design, construction and test. Limitations imposed by the distribution system and storage and transportation environments as set forth in AMCP 706-121 shall be considered. Design for air transportation shall take into account air pressure at 50,000 feet (5.00 inches of mercury or 2.47 pounds per square inch). Department of Transportation Hazardous Materials Regulations shall be adhered to in designing packages and packs for hazardous items.

3.3.4 Containers with reusable features or of special design (see 6.4). As required and when approved by the procuring activity, containers with reusable features or of special design will be provided for CEI's, critical items (see 6.3.2), items of high value (see 6.3.5) which are to be returned by the user for rebuild or repair, and highly fragile or delicate items (see 6.3.3 and 6.3.4).

3.3.5 Humidity control. Desiccated breather systems of the type \* required by MIL-P-45213 shall be provided for vans and shelters containing equipment requiring controlled humidity. In other applications of controlled humidity, the criteria set forth in AMCP 706-121 and MIL-P-116 shall be used as guidance in package design. Packages in which desiccant will be required shall be provided with humidity indicators. Plug type indicators conforming to MIL-I-26860 shall be provided for Method IIa in all cases and also for other Method II packs which will require continuing surveillance in storage. Card type indicators conforming to MS20003 shall be provided in all other Method II packs. Windows shall not be provided in such packs unless approved by the procuring activity.

3.3.6 Methods of preservation. Methods of preservation shall be selected from MIL-P-116. As far as practical, the cleaning and drying procedures set forth therein shall be utilized. The criteria provided in MIL-P-14232 shall be utilized where appropriate in development requirement for repair parts and components. Preservation requirements developed for ground support equipment shall be in accordance with \* MIL-P-45213.

3.3.7 Load deflectors and stiffeners. Items which require protection from compression set or other deformation shall be provided with an appropriate (low cost, low weight, high strength) type of load deflector or stiffener.

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3.3.8 Blocking and bracing. Applications of blocking and bracing shall be in accordance with MIL-STD-1186.

3.3.9 Package cushion design. The design criteria contained in MIL-HDBK-304 and the requirements of this specification, as applicable, shall be utilized in the development of cushioning systems to protect items from shock and vibration induced during shipping and handling. Hygroscopic cushioning materials shall be provided to preclude loss of cushioning effect in event part of the packaging material is removed for air or conex shipments.

### 3.4 Performance requirements.

- \* 3.4.1 Rough handling. The container or pack shall withstand the shocks and vibration incurred in transportation and handling without evidence of structural weakness or functional defects. Rough handling tests (see 3.2) shall be in accordance with 4.5.2.
- \* 3.4.2 Magnetic shielding. Shielding provided for magnetic items subject to air shipment shall reduce the magnetic field at seven feet from the outer extremity of the package to not greater than 5.25 milligauss, or shall not cause a compass to exceed two degrees maximum deviation at seven feet. Measurements of magnetic fields shall be as specified at 4.5.3.
- \* 3.4.3 Methods of preservation. The container or pack shall maintain environmental protection required by the applicable method of preservation, container drawing or specification. Tests for methods of preservation (see 3.2) shall be as specified in 4.5.1.
- \* 3.4.4 Temperature. The container or pack shall withstand vibration and rough handling in the temperature range 71°C (160° F) to -54° C (-65° F), and shall provide protection to the item when subjected to the following storage conditions:
  - a. High temperature: Air temperature of 71°C (160°F) for periods up to four hours daily without benefit of solar radiation and with negligible air movement. Absolute humidity, 13 grains/ft.3. Material temperature under these conditions depends on thermal capacity and mass of stored items.

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b. Low temperature: Air temperature of  $-54^{\circ}\text{C}$  ( $-65^{\circ}\text{F}$ ) for 12 hours daily without benefit of solar radiation and with negligible air movement.

c. Extreme low temperature: Air temperature of  $-62.2^{\circ}\text{C}$  ( $-80^{\circ}\text{F}$ ) for three days without benefit of solar radiation and negligible air movement.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Pilot model. When required (see 3.2) a pilot model shall be prepared on all special design containers and on all new packaging methods which are a departure from previously developed methods. The contractor shall inform the procuring activity when tests are to be performed so that a Government representative may be designated to witness the tests. If the sample fails to pass inspection, the contractor shall change the process to correct the cause of the defect and again submit the pack to prove the corrective action. The pilot model tests shall consist of all tests specified herein, including measurements of magnetic fields as appropriate, and as required by applicable reference specifications and such newly developed specifications which are pertinent to the pack being tested.

#### 4.3 Acceptance testing.

4.3.1 Special containers or newly developed packs. For special design containers or newly developed packs, acceptance tests shall consist of all the tests in this specification deemed necessary (see 3.2) to determine that the pack or container satisfies the requirements of this specification for structural integrity and protection to the packaged item.

- \* 4.3.2 Ground support equipment and hazardous items. Preparation for
- \* delivery requirements of ground support equipment and hazardous items shall
- \* be subjected to inspection as specified in MIL-P-45213.

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- \* 4.4 Test conditions. Prior to conducting the tests specified herein
- \* (see 4.5.1, 4.5.2 and 4.5.3), each package shall be loaded with its intended component or with a dummy load fully representative of the intended component. Intended component shall only be used when approved by the procuring activity.

- \* 4.4.1 Instrumentation for rough handling tests (see 4.5.2).  
Calibration accelerometers shall be positioned directly on the component, and sufficient channels shall be used to permit detection of shock sustained by the component during drop tests at its center of gravity and each of its ends in all three mutually perpendicular axes, as well as at any other points where measurement of shock pulse is necessary to determine structural integrity and performance. When a test package is involved in more than one temperature condition, the accelerometers shall be recalibrated. As required, thermocouples shall be placed in the package for detecting temperature conditions. The accelerometers and thermocouples specified for drop tests may be used as appropriate for vibration tests with the accelerometers functioning as vibration measuring pickups to detect and permit defining of critical resonant frequencies and associated vibration mode shapes.

- \* 4.4.2 Instrumentation for measurement of magnetic fields (see 4.5.3).

4.4.2.1 Compass. The compass used shall be accurate to minus .5 degree indicated value and should be calibrated in .5 degree increments (.5 degree equals 30 minutes) or less.

4.4.2.2 Instrumentation. Instrumentation shall be accurate to minus 20 percent random and system error at 5.25 milligauss and shall embrace the cumulative error or all applied instrumentation.

4.4.3 Temperature conditioning. Packages shall be conditioned as follows:

a. High temperature: Condition until temperature is stabilized at 71°C (160°F). Stabilization will have been attained when there is a change of no more than 0.56°C (1°F) per hour on all thermocouples.

b. Low temperature: Condition until temperature is stabilized at -54°C (-65°F). Stabilization will have been attained when there is a change of no more than 0.56°C per hour on all thermocouples.

c. Room temperature: Condition until temperature is stabilized at 23°C (73°F). Stabilization will have been attained when there is a change of no more than 0.56°C per hour on all thermocouples.

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4.5 Pilot model tests.

4.5.1 Methods of preservation. Tests of methods of preservation shall be in accordance with the requirements of MIL-P-116.

\* 4.5.2 Rough handling tests (see 4.4). Packs prepared for shipment shall be tested in accordance with MIL-P-116 after conditioning as specified in 4.4.3 and subjected to each test while at each of the specified temperatures.

\* 4.5.3 Measurement of magnetic fields. Measurements shall be made from a circle of seven feet from the outer extremity of the package as prepared for shipment. Data shall be compiled which reflects the magnetic flux density or the maximum compass deviation at each of the eight cardinal points of the compass rose depict (see 4.5.3.1) with the package resting on each of its six faces in such a manner as to measure this density for each of four edge of six faces (see 4.5.3.2).

\* 4.5.3.1 Compass rose. A circle shall be inscribed in an area which is free from any magnetic interference other than the earth's magnetic field. With the package removed from the vicinity of the testing area, magnetic north shall be determined and the periphery of the circle marked at 45 degree increments beginning at magnetic north (see Figure 1). For gauss measurements, adjustment shall be made for any difference between geographical north and magnetic north. These differences may be determined from data compiled by the U.S. Coast and Geodetic Survey and published in "Magnetism of the Earth".

\* 4.5.3.2 Identification of pack faces and edges. The edges of the package to be tested shall be marked to identify each edge of each of the six faces (see Figure 2). When marking, the package shall be turned clockwise as it rests on the bottom. Face A shall be the marked side, face B shall be adjacent to face A, face C opposite face A and Face D adjacent to faces A and C. Face E shall be the top and face F the bottom of the package.

\* 4.5.4 Interpretation of results of testing. Any of the following conditions shall be cause for rejection:

a. Shock exceeding the fragility limitation established for the component.

b. Damage to cushioning materials and package structure.



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c. Evidence of displacement which will affect the utility of the package.

d. Transmissibility of excitation forces on the packaged item during vibration tests which exceed the allowable response established by the design criteria for the packaged item.

e. Rise of cushioning material temperature to the point of thermal instability for either the material or the packaged component.

f. A compass deviation of more than two degrees or a gauss reading of more than 5.25 milligauss.

## 5. PREPARATION FOR DELIVERY

Not applicable to this document.

## 6. NOTES

6.1 Intended use. This specification is for use in the design, development and testing of packaging and packing requirements for the complete weapon system. The requirement and tests specified herein are intended to assure that designed packaging will function as required, with respect to transportation, storage, handling and environmental conditions.

6.2 Ordering data. Procurement documents should specify the title, number and date of this specification.

### 6.3- Definitions.

6.3.1 Item. The term item or items when used alone, or otherwise inferred, includes the CEI's, major or critical components, assemblies and all related parts, collectively.

6.3.2 Critical items. Critical items are those meeting one or more of the following criteria:

a. Items having close tolerances or that are of delicate construction or of perishable nature, the deterioration of which would result in premature failure or malfunction of the item or equipment in which installed or to which the item is related.

b. Items not covered by paragraph 6.3.2.a but which, if deteriorated or contaminated, would endanger personnel, equipment or facilities by creating unsafe or hazardous operating conditions.

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c. Items not meeting the criteria of paragraphs 6.3.2.a or 6.3.2.b but which are so constructed that damage or deterioration would result in excessive repair or overhaul costs, or create production delays because of long procurement lead time for replacement items.

6.3.3 Delicate items. Delicate items are those that are finely made or constructed and easily damaged or broken by shock or vibration normally encountered in transportation and handling, e.g., closely calibrated and precision assemblies such as instruments, gyro assemblies, etc.

6.3.4 Fragile items. Fragile items are those that are easily broken, shattered or destroyed by shock or vibration normally encountered in transportation and handling, e.g., electric lamps, lenses, etc.

6.3.5 High dollar value, low density, technically complex items. The definition of these items cannot be established arbitrarily by setting a fixed item dollar value because of the variances in the costs of weapon systems. Therefore, the weapon system managers will identify these items for their assigned systems.

6.4 Special design packages. Packages are regarded as special design when materials, procedures or containers are used which either do not conform to any existing specification or standard, or are modifications of existing specifications or standards, or conform to a performance specification but include special features such as thermal insulation, combined materials handling and packaging capability, unique shock absorbing system, etc. Other factors of special design include, but are not limited to; unusual size, weight or weight distribution; requirement for protection to a specifically stated value of acceleration; requirement for controlled shipping and storage temperatures or pressures; requirement for protection against restrictive or corrosive atmospheres; requirement for magnetic shielding. Special design alone does not necessarily provide the basis for pilot pack testing. There should be firmly established needs for proof testing of containers or packages to determine rough handling capabilities, ability of cushioning systems to mitigate shock and vibration to items with critical fragility factors, etc.

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- \* 6.5 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:  
Army - MI

Preparing Activity:  
Army - MI

Project No. PACK-A152

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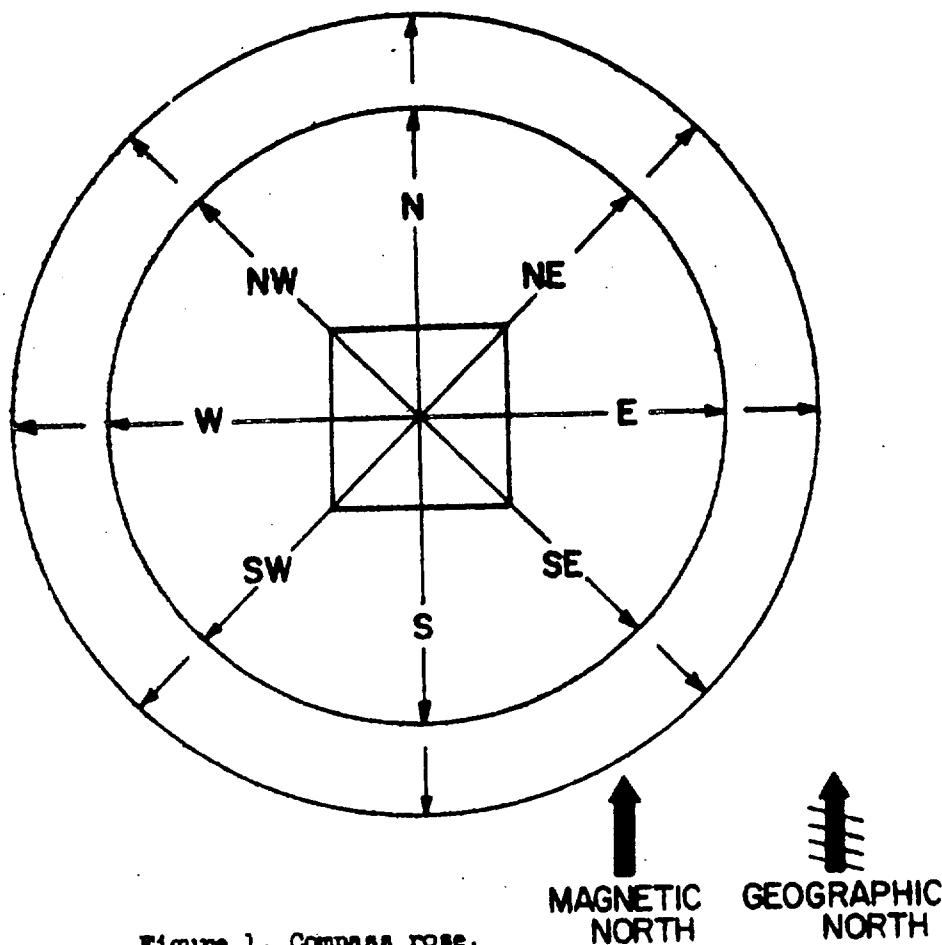


Figure 1. Compass rose.

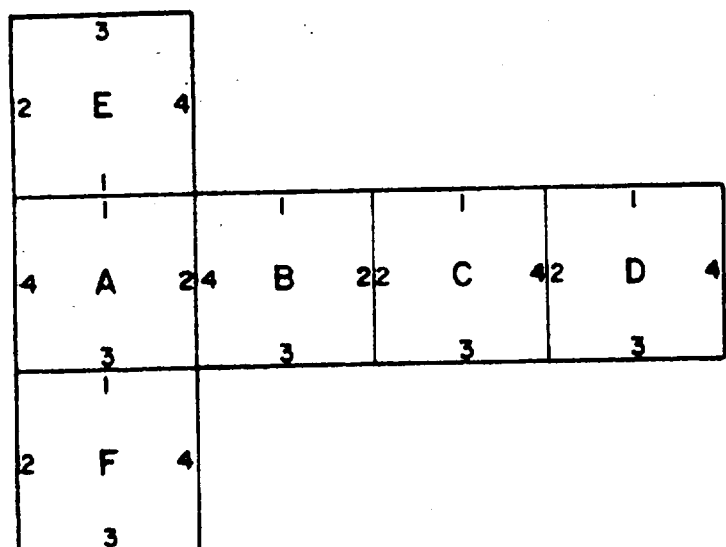


Figure 2. Identifying faces and edges of package.

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