MIL-STD-1365A
20 JULY 1981

SUPERSEDING
MIL-STD-1365
27 APRIL 1972

MILITARY STANDARD

GENERAL DESIGN CRITERIA FOR HANDLING EQUIPMENT ASSOCIATED WITH WEAPONS AND RELATED ITEMS

"NO INFORMATION REQUIREMENTS"

PACK

DEPARTMENT OF DEFENSE
Washington, D.C. 20301

General Design Criteria for Handling Equipment Associated with Weapons and Related Items.

MIL-STD-1365A

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Ordnance Station, Standardization/Documentation Division (524), Indian Head, MD 20640 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. Copies of this standard may be obtained from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

FOREWORD

This standard was prepared to establish general design criteria for handling equipment associated with weapons and related items. No specific piece of gear will incorporate all these design or test requirements. Criteria applicable to a specific piece of equipment must be selected.

CONTENTS

CONTENTS — Continued

CONTENTS — Continued

CONTENTS -- Continued

CONTENTS — Continued

CONTENTS — Continued

CONTENTS -- Continued

TABLES

MILITARY STANDARD

GENERAL DESIGN CRITERIA FOR HANDLING EQUIPMENT ASSOCIATED WITH WEAPONS AND RELATED ITEMS

1. SCOPE

1.1 Scope. This standard contains general design criteria and applicable tests for beams, bands, strongbacks, cradles, assembly stands, slings, dollies, bomb loaders, trailers, and hoists associated with handling of weapons and related items.

2. REFERENCED DOCUMENTS

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

SPECIFICATIONS

MILITARY

MIL-S-901	Shock Tests, H. I. (High-Impact), Shipboard Machinery, Equipment and Systems, Requirements for
MIL-E-917	Electric Power Equipment, Basic Requirements for (Naval Shipboard Use)
MIL-R-2726/37	Receptacle, Electrical, 15 Amp, 125 Volts, 60 Hertz, Bladed Type, Grounded (Symbol 1099.1)
MIL-R-2726/38	Receptacle Plug, Electrical, 15 Amp, 125 Volts Bladed Type, Grounded (Symbol No. 1218.3)
MIL-F-3541	Fittings, Lubrication
MIL-G-4343	Grease, Pneumatic System
MIL-A-5070	Adapter, Hose to Tube, Pipe and Flange, Reusable; Hydraulic, Fuel and Oil Lines
MIL-W-5086	Wire, Electrical, Polyvinyl Insulated Copper or Copper Alloy
MIL-B-5087	Bonding, Electrical, and Lighting Protection, for Aerospace Systems
MIL-F-5509	Fitting, Flared Tube, Fluid Connection
MIL-G-5514	Gland Design, Packing, Hydraulic, General Requirements for

MIL-P-5518	Pneumatic Systems, Aircraft, Design, Installation and Data Requirements for
MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-M-8090	Mobility, Towed Aerospace Ground Equipment, General Requirements for
MIL-A-8421	Air Transportability Requirements, General Specification for
MIL-T-8504	Tubing, Steel, Corrosion-Resistant (304), Aerospace Vehicle Hydraulic Systems, Annealed, Seamless and Welded
MIL-S-8512	Support Equipment, Aeronautical, Special, General Specification for the Design of
MIL-A-8591	Airborne Stores, Associated Suspension Lug, and Aircraft Store Interface (Carriage Phase), General Design Criteria for
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-H-8788	Hose, Hydraulic and Pneumatic, High Pressure
MIL-F-8789	Fitting End, Attachable Hydraulic, High Pressure Hose
MIL-H-8790	Hose Assembly, Rubber, Hydraulic, High Pressure (3,000 psi)
MIL-H-8794	Hose, Rubber, Hydraulic, Fuel and Oil Resistant
MIL-H-8795	Hose Assemblies, Rubber, Hydraulic, Fuel and Oil Resistant
MIL-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15 Micron Absolute and 5 Micron Absolute, Type II Systems, General Specification for
MIL-R-12144	Reflector, Indicating, Clearance
MIL-H-19253	Hook, Hoist
MIL-H-22072	Hydraulic Fluid, Catapult
MIL-P-24441	Paint, Epoxy-polyamide, Green Primer Formula 150
MIL-D-24483	Deck Covering, Spray On, Nonslip
MIL-P-25732	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 275° F

MIL-T-46736	Tanks, Fuel, Engine: General Requirements for
MIL-M-52590	Muffler, Exhaust, Internal Combustion Engine, General Purpose
MIL-R-81090	Rubber, Electrically Conductive, Fuel Resistance
MIL-H-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft
MIL-B-83769	Battery, Storage, Lead-Acid, General Specification for
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-167-1	Mechanical Vibrations of Shipboard Equipment (Type I Environmental and Type II Internally Excited)
MIL-STD-171	Finishing of Metal and Wood Surfaces
MIL-STD-186	Protective Finishing Systems for Rockets, Guided Missiles, Support Equipment and Related Materials
MIL-STD-209	Slinging Tiedown Provisions for Lifting and Tying Down Military Equipment
MIL-STD-262	Test and Inspection of Crane Truck, Warehouse, Electric Solid Rubber Tires
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Interference Characteristics, Test for Equipment
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-463	Definitions and Systems of Units Electromagnetic Interference Technology
MIL-STD-471	Maintainability Demonstration
MIL-STD-721	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors and Safety
MIL-STD-740	Airborne and Structureborne Noise Measurements and Acceptance Criteria of Shipboard Equipment
MIL-STD-777	Schedule of Piping, Valves, Fittings and Associated Piping Components for Naval Surface Ships
MIL-STD-781	Reliability Tests, Exponential Distribution

MIL-STD-808	Finishes, Protective and Code for Finishing Schemes for Ground Support Equipment
MIL-STD-810	Environmental Test Methods
MIL-STD-814	Requirement for Tiedown, Suspension and Extraction Provisions on Military Material for Airdrop
MIL-STD-882	System Safety Program Requirements
MIL-STD-889	Dissimilar Metals
MIL-STD-965	Parts Control Program
MIL-STD-1303	Painting of Naval Ordnance Equipment
MIL-STD-1310	Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety
MIL-STD-1319	Item Characteristics Affecting Transportability and Packaging and Handling Equipment Design
MIL-STD-1366	Packaging, Handling, Storage, and Dimensional Constraints, Definition of
MIL-STD-1399 Section 300	Interface Standard for Shipboard Systems, Section 300, Electric Power, Alternating Current
MIL-STD-1472	Human Engineering, Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-1474	Noise Limits for Army Material
MS 21344	Fitting, Installation of Flared Tube, Straight Thread Connectors, Design Standard for
MS 21919	Clamp, Cushioned, Support, Loop-Type, Aircraft
MS 24523	Switch, Toggle, One Pole, Environmentally Sealed
MS 24524	Switch, Toggle, Two Pole, Environmentally Sealed
MS 33584	Tubing End, Standard Dimensions for, Flared
MS 33611	Tube, Bend, Radii
MS 33649	Boss, Fluid Connection-Internal Straight Thread

MS 33656	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seals
MS 33657	Fitting End, Standard Dimensions for Bulkhead Flared Tube Connections
MS 51335	Pintle Assembly, Towing, 18000 lbs Cap., Manual R
MS 51336	Lunette Coupler, Drawbar, Ring
MS 52128	Switch, Vehicular Lights, 24 Volt DC Waterproof

DRAWINGS

NAVAL SEA SYSTEMS COMMAND (Code Ident. 53711)

2643075	Swaged Sleeve Endings for Wire Rope Slings

PUBLICATIONS

HANDBOOK

MIL-HDBK-157	Transportability Criteria

MANUALS

DEPARTMENT OF THE ARMY

TM 5-330	DA Technical Manual, Planning and Design of Roads, Airbases, and Heliports in Theater of Operations

DEPARTMENT OF THE NAVY

NAVSHIPS 0902-001-5000	General Specification for Ships of the United States Navy

BULLETINS

NAVAL AIR SYSTEMS COMMAND (Code Ident. 30003)

16-1-529	Radio Frequency Hazards to Ordnance Personnel, and Fuel
AR 70-47	Restraint of Cargo for External Airlift

(Copies of specifications, standards, drawings, publications and bulletins required by contractors 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 standard to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

DEPARTMENT OF DEFENSE

DOD 4145.26M	DOD Contractors' Safety Manual for Ammunition, Explosives and Related Dangerous Material

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B30	Material Handling Equipment
ANSI MH15.1-72	Glossary of Packaging Terms
ANSI S1.1-60	Acoustical Terminology (Including Mechanical Shock and Vibrations)

(Application for copies should be addressed to the American National Standards Institute, Department 1270, 1430 Broadway, New York, NY 10018.)

UNITED STATES DEPARTMENT OF AGRICULTURE (FOREST)

STANDARD 5100-1A	Spark Arrestors for Internal Combustion Engines

(Application for copies should be addressed to the Boise Interagency Fire Center, 3905 Vista Ave., Boise, Idaho 83705.)

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA No. 70-1978	National Electric Code

(Application for copies should be addressed to the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. DEFINITIONS

3.1 General. The following terms are used throughout this standard, and their interpretation shall be in accordance with the following definitions. Except as otherwise indicated, definitions for shock and vibration terms are in accordance with ANSI S1.1. Definitions for packaging terms are in accordance with ANSI MH 15.1.

3.1.1 AEODA. Acronym denoting ammunition, explosives, and other dangerous articles.

3.1.2 Connected replenishment (CONREP). The operation of transferring cargo between ships while underway, by means of connected lines between the ships.

3.1.3 Design load. The load to which the equipment is actually designed, i.e., the rated load × the design or safety factor. See Table I.

3.1.4 Design proof load. The maximum test load which will demonstrate the capability of equipment to perform without permanently deforming or breaking. Applicable to prototype equipment only and not production. This test is considered destructive.

3.1.5 Design stress. The stress that will be imposed on the equipment or its components when the allowable working load is applied to the equipment.

3.1.6 End product. A part which is essential to the first time assembly of the system by the Government. This definition specifically excludes inert spare parts and spare or repair parts unless specifically designated in the contract or order.

3.1.7 Explosive. The term explosive includes any chemical compound or mixture which, when subjected to heat, friction, detonation or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases which exert pressures in the surrounding medium.

3.1.8 Fail-safe. A fail-safe condition exists when failure does not result in damage to the load or uncontrolled movement of the load or the handling equipment itself, nor jeopardize the safety of personnel. In the event of power failure, the load and the equipment become immobilized by means of a safety device or devices.

3.1.9 Handling. Moving material from one place to another within a limited range.

3.1.10 Handling equipment. Equipment designed and used to make handling possible, easier, or more efficient.

3.1.11 Inert. A part which contains neither a class A, B, or C explosive nor a class A, B, or C poison nor an etiological agent.

3.1.12 Loading equipment. Equipment that is used to load or unload a weapon.

3.1.13 Longitudinal. Pertaining to an axis running lengthwise.

3.1.14 Mobile equipment. Handling equipment that is provided with wheels, tracks, or runners in order to travel over a specified surface including equipment which requires either human or mechanical power to move. Equipment excluded are fork lift trucks and pallet trucks.

3.1.15 Mobility Index (MI). A number which results from a consideration of certain vehicle characteristics [see DA Technical Manual TM 5-330 (AFM-86-3 Vol. II)].

3.1.16 Munitions. Parts of nuclear and nonnuclear explosives in any case or contrivance prepared to form a charge, complete round, or cartridge for cannon, howitzer, mortar, or small arms; or for any other weapon, torpedo, naval mine, land mine, bomb, depth charge, demolition charge, fuze, detonator, projectile, grenade, guided missile, rocket, and the like; signaling and illuminating pyrotechnic materials; explosive-loaded impulse devices such as explosive bolts, squibs, and catapult charges; and dangerous chemical materials.

3.1.17 Nonstandard part. Any part that does not meet the definition of 3.1.30.

3.1.18 Nonmobile equipment. Equipment not meeting the definition of mobile equipment. May use mechanical or electrical power to perform its intended function, or may not require power. Examples of the latter are slings, storage or stowage racks, and assembly stands.

3.1.19 Pitch (tilt). An angular rotation about the center of motion of the longitudinal axis in the vertical plane.

3.1.20 Positive control. Physical restraint from uncontrolled movement in all attitudes. The load does not become disengaged from its handling equipment during any phase of a sequential handling operation, and the operation is under complete control of a human operator or operators while in motion.

3.1.21 Ram (heave). A linear travel of the longitudinal axis in the vertical plane.

3.1.22 Rated load. The gross weight which the equipment is designed to handle (i.e., lift, move, restrain) and still meet the requirements of this standard (synonymous with capacity and safe working load

3.1.23 Roll An angular rotation about the center of motion of the athwartship axis in the vertical plane.

3.1.24 Safe. Freedom from those conditions that can cause injury or death to personnel or damage or loss to equipment or property.

3.1.25 Safety factor The ratio of the yield of material to the allowable design stress

3.1.26 Shipment. Transfer for an appreciable distance using equipment commonly available to or usable by common carriers such as railcars, ships, aircraft, barges, or trucks.

3.1.27 Shipping configuration. The assemblies of end product(s) in or on a transport vehicle (including ISO container or 463L pallet) together with all blocking, bracing, or other restraining devices.

3.1.28 Shipping container. A structure intended to protect an item of supply or product from the hazards of handling, shipment, and storage.

3.1.29 Shipping skid or cradle. A simple platform or similar device attached to an end product to make handling, storage, and shipment easier.

3.1.30 Standard part. A part covered by contractually required general equipment specification or as otherwise stated in the contract.

3.1.31 Underway replenishment (UNREP). The operation of transferring cargo, fuel, and personnel from one ship to another while both are underway (includes VERTREP and CONREP).

3.1.32 Vehicle Cone Index (VCI). The index assigned to a particular vehicle which indicates the minimum soil strength, as defined by the Soil Cone Index (SCI), required for traversing of said soil [see DA Technical Manual TM 5-330 (AFM-86-3, Vol. II)].

3.1.33 Vertical replenishment (VERTREP). The operation of transferring solid cargo from one ship to another by means of a helicopter while both ships are underway.

3.1.34 Yaw. An angular rotation about the center of motion of the longitudinal axis in the horizontal plane.

4. GENERAL REQUIREMENTS

4.1 General In designing specific pieces of handling, shipping, and transporting equipment, the following basic design goals consistent with the primary objectives of ensuring safety and reliable function shall be met. Appearance shall be dictated only by functional utility; avoid all nonfunctional embellishments. Requirements for Ground Support Equipment other than Weapons Handling Equipment shall conform to MIL-S-8512. Human engineering factors shall be in accordance with MIL-STD-1472.

4.1.1 Standard parts. Standard parts (AN and MS or commercially equivalent) shall be used wherever they are suitable for the purpose.

4.2 Safety.

4.2.1 AEODA safety. Equipment for handling AEODA shall permit safe operation in accordance with DOD 4145.26M. Positive control shall be exercised at all times while handling AEODA, such as dead-man controls or braking mechanisms. Positive control shall include elimination of the possibility of dropping or losing a load. Any undue shock imparted on the load such as that caused by shifting, swaying, swinging, or motion of the load on the carrying equipment shall be prevented. Hydraulic systems shall have hydraulically operated "fail-safe" devices such as counterbalance valves in pushing and lifting mechanisms. Emphasis shall be placed on cradling and restraining mechanisms so as not to compromise safety during intermediate transfer of munitions. Systems shall be designed for proper structural load capabilities incorporating fail-safe devices. All Powered equipment used for handling AEODA shall be non-spark producing or explosion-proof coupled with the respective specific requirements of the NFPA No. 70-1978. (For electrical bonding and grounding requirements, refer to 4.7.5.)

4.2.1.1 System safety. Equipment for handling AEODA shall be designed to assure that safety consistent with mission requirements, is designed into systems. MIL-STD-882 shall be utilized to develop a system safety program.

4.2.2 Personnel safety. Provisions shall be incorporated for the safety of personnel to the maximum extent possible, with all anticipated operating conditions and the capability of operating personnel under these conditions being considered. System components shall be incapable of being actuated by means other than the operator.

4.2.2.1 Guards. Suitable guards shall be provided for exposed moving parts such as belts, chains, gears, and linkages with which the operator may come in contact during normal operation of equipment. Guards or enclosures shall be provided for otherwise exposed electrical portions of equipment. Guards shall allow for inspection of mechanisms whose failure could cause a hazardous condition.

4.2.2.2 Sharp edges. Sharp edges, projections, and hinged devices with hazardous characteristics that could injure personnel shall be avoided.

4.2.2.3 Electrical shock. Suitable interlocks, grounding means, enclosures, or protective devices conforming to NFPA No. 70-1978 or equivalent industry standard shall be employed so that danger from electrical shock is avoided.

4.2.2.4 Securing. Parts which may cause a hazardous condition by working loose in service shall be safety wired, or shall have other approved positive locking means applied.

4.2.2.5 Toxic gases. Special design attention shall be paid to those items that emit toxic gases that could be harmful to operators or other personnel in vicinity.

4.2.3 Noise. The noise level of the equipment shall be designed as not to exceed 85 dBA at the operator's position. MIL-STD-740 and MIL-STD-1474 shall be used as applicable.

4.2.4 Reflectors. Reflectors shall be provided in accordance with MIL-R-12144.

4.3 Maintenance considerations.

4.3.1 Accessibility. Components requiring frequent inspection shall be made as accessible as possible. Removable covers, access doors, or plates may be used provided these are secured to the item in suitable fashion to prevent loss.

4.3.2 Disassembly provisions. Provisions shall be made for ready replacement of major assemblies which may require replacement, major repair, or overhaul, without requiring prior removal of other assemblies, or insofar as possible, not requiring draining liquid-filled systems. Connecting and disconnecting features shall be arranged so as to preclude the possibility of incorrect assembly. All disconnect points shall be identified. Elaborate torquing criteria shall be avoided.

4.3.3 Lubrication. Requirements for field lubrication shall be minimized. Maximum use shall be made of prelubricated bearings. The number of grease fittings shall be minimized. Grease fittings shall be readily accessible and shall comply with MIL-F-3541. All fittings shall be of the same size on a single piece of equipment, if practicable.

4.3.4 Storage. Storage space shall be provided for maintenance tools, equipment, parts and instruction handbooks which may be necessary to accompany the equipment when in use.

4.3.5 Fasteners, fittings, and connectors. Captive, quick-disconnect fasteners with a positive locking means shall be used on component covers and access plates. Self-locking nuts are preferred and shall be used on all fasteners in assemblies which are subject to significant operating vibration in service. Readily attachable and detachable type fittings shall be used in hydraulic and pneumatic systems when practicable. Multiple-line connectors, receptacles, and disconnect plugs shall be incorporated in electrical systems. Riveted connections shall be used only in pure shear applications.

4.3.6 Supports and rollers. If cradles are used, they shall be faced with a suitable material, well bonded, that will not scratch or otherwise mar the surface of any weapons. If support rollers are used, they shall be free rolling and of a material that will not damage the surface of the weapon. When using cradles or support rollers, they shall be adjustable on or within the full limit of the designated chocking area of any weapon as defined in MIL-A-8591 and MIL-STD-1319. Complete latitude of adjustment is necessary to permit proper location of weapon center-of-gravity to ensure stability. Total width of cradles or support rollers shall normally be limited to 3½ inches including supporting structures to prevent interference with weapons.

4.4 Structural design.

4.4.1 Design stress safety factors. Weapons handling equipment shall be designed to the minimum safety factors, as specified in Table I. Safety factor is the ratio of the yield or ultimate strength, as required, of the material to the allowable mechanical stress. The design proof load requirements are the maximum test loads which will demonstrate the capacity of the equipment to perform without permanent deformation of any part of the equipment.

TABLE I. Acceptable safety factors and design proof loads

Item	Safety Factors			Safety Proof Load		
	Navy (min)	Air Force	Army	Navy	Air Force	Army
Lifting Devices (Metallic)	5:1* (yield)	***	ANSI B30	5:1	***	ANSI B30
Lifting Devices (Non-Metallic)	5:1 to 10:1**	***		5:1 to 10:1	***	
Stands, Cradles Adapters, etc.	3:1 (yield)	***		3:1	***	
Loaders, Trailers, etc.	3:1 (yield)	***		3:1	***	

*Under unique circumstances, where the using environment can be determined and controlled, the 5:1 requirement may be reduced by waiver from the procuring activity.

**Depending on creep characteristics (see 4.4.3.1)

***As prescribed in individual development or procurement specifications.

4.4.2 Design stresses for handling equipment not involved in lifting or hoisting. Design stresses for all metal devices, except trailers, developed under this standard, such as assembly fixtures, dollies, support stands, and cradles used to handle or move (not lift more than 12 inches) equipment, shall have a safety factor of 3:1. They shall be based on the yield strength of the material. Nonmetallic elements shall have a safety factor of 4:1, based on the ultimate strength. (Trailer requirements are specified in Table I.)

4.4.3 Design stresses for lifting equipment.

4.4.3.1 Nonmetallic materials. Nonmetallic materials shall not produce more than 1 percent permanent deformation when loaded to one and one half times the rated load measured 24 hours after removal of the load. To avoid excessive creep, the design load should be selected in the range of one-tenth to one-fifth of the breaking strength, the former being preferred. In addition, the material shall not break when loaded to five times the rated load.

4.4.3.2 Metallic elements. Requirements for metallic elements are specified in Table I.

4.4.3.3 Wire rope, chain and associated fittings. The rated loads shall not exceed 16 percent of the minimum breaking strength. Swaged wire rope endings shall be in accordance with NAVSEA Dwg 2643075. Natural fiber core wire rope *shall not be used* for lifting equipment developed under this standard. The use of chain in lifting equipment is permissible but not desirable. In selecting materials for lifting equipment, effects of deflection under load and repeated loading shall be considered in accordance with MIL-HDBK-157.

4.4.3 4 Multiple-leg slings. Each leg of a multiple-leg sling shall be capable of supporting the entire rated load.

4.4.4 Weight. Simple construction shall be used, to the maximum extent consistent with military service requirements, to provide a low net weight consistent with human engineering requirements, safety, and reliability. Maximum permissible gross weight of any unit (e.g., missile and transfer dolly) during UNREP is 6000 pounds with a 4000-pound maximum preferred. Simplicity, reliability, safety or strength shall not be sacrificed to save weight.

4.4.5 Materials. Materials used for components, which are likely to be subjected to adverse weather conditions, shall be either protected against deterioration or made of materials that do not deteriorate under climatic and environmental conditions. The use of protective coating that will crack, chip or scale shall be avoided.

4.4.5.1 Dissimilar metals. The use of dissimilar metals shall be in accordance with MIL-STD-889.

4.4.5.2 Corrosion. Metal parts subject to corrosion shall be protected with surface treatments and coatings, in accordance with MIL-STD-1303, MIL-STD-171, MIL-STD-186, MIL-STD-808, or as otherwise specified by the procuring activity. Cadmium coating or plating shall not be used on any Government equipment

4.4.5.3 Fungus proof materials. Materials that are nutrients for fungi shall not be used where it is practical to avoid them. In the event they are used and not hermetically sealed, the item shall be treated with a suitable fungicidal agent (see 4.9.2).

4.5 Hydraulic systems

4.5.1 General. Hydraulic systems and parts shall be designed to operate satisfactorily under all conditions which the equipment may be expected to encounter. They shall conform to sound design practice with respect to flow constriction, structural design and strength. Considerations shall be given to baffles, fluid connectors, sumps, drain vents, filters, inlet filter units and heat exchangers.

4.5.2 Materials. Materials used in the manufacture of hydraulic systems equipment shall be of high quality, suitable for the purpose, and shall conform to applicable Government specifications. Materials conforming to commercial specifications may be used, provided that they are at least equivalent to Government specifications with respect to mechanical properties, and that a cost saving can be accomplished.

4.5.2.1 Metals. Metals shall be compatible with fluid and intended temperature; and shall conform to the functional, service, and storage conditions to which the components and system will be exposed. Magnesium shall not be used.

4.5.2.2 Plastic parts. Plastic parts shall be suitable for the system environment and the fluid being used. Their use shall be subject to the approval of the procuring activity.

4.5.2.3 Plating. Metal coatings, which have been demonstrated to be satisfactory to the Government, may be used. Aluminum alloys shall be anodized in accordance with MIL-A-8625 Type II coating except that, in the absence of abrasive conditions, the anodize may be Type I coating where applicable, or may be a chemical film in accordance with MIL-C-5541. Ferrous alloys shall be internally and externally protected against corrosion In addition, cadmium or zinc plating shall not be used for internal parts, or on internal surfaces in contact with hydraulic fluid or exposed to its vapors. Cadmium plating shall not be used on any Government equipment.

4.5.2.4 Hydraulic fluids. Except for closed hydraulic brake systems, 3% of hydraulic fluids shall conform to MIL-H-5606 or MIL-H-83282. Use of commercial product hydraulic fluid ATF, Type A, suffix 'A' is acceptable. When system pressure is greater than 600 psi. use safety type fluid MIL-H-22072.

NOTE: Hydraulic fluid ATF, Type A, suffix 'A' is not compatible with hydraulic fluid conforming to MIL-H-5606 and MIL-H-83282.

4.5.3 Pressure limitations.

4.5.3.1 System pressure Hydraulic or pneumatic equipment shall be provided with red-lined gauges to indicate safe limits of operation. Peak pressure resulting from any phase of the system operation shall not exceed 135 percent of the system operating pressure.

4.5.3.1.1 Relief pressure. Relief pressure should be set at no more than 10 percent above operating pressures at maximum operating temperatures.

4.5.3.2 Back pressure. The system shall be designed so that proper functioning of any unit will not be affected by the back pressure or changes in the back pressure in the system.

4.5.3.2.1 Supply pressure redundancy. For hydraulically powered armament lifting devices, a manual hand pump shall be included in the system to supply pressure in case of primary source malfunction or failure. This secondary pressure shall provide sufficient power to raise or lower the rated load, however, it may be at a reduced rate of motion. Manual input levers required shall conform to MIL-STD-1472.

4.5.4 Components.

4.5.4.1 Tubing, hoses, and fittings. Tubing shall be corrosion resistant steel conforming to MIL-T-8504. Hoses and end fittings shall conform to MIL-H-8794, MIL-H-8795, and MIL-A-5070 for medium pressure and MIL-H-8788, MIL-F-8789, and MIL-H-8790 for high pressure. Fluid connection fittings shall conform to MIL-F-5509. Schedule of piping, valves, fittings and associated piping components for Naval surface ships shall be in accordance with MIL-STD-777

4.5.4.1.1 Tubing safety factors. Tubing in the hydraulic system operating at pressure from 0 to 1000 psi. should have a safety factor of 8:1. For operating pressures from 1000 to 2500 psi. the tubing should have a safety factor of 6:1. For operating pressures beyond 2500 psi., the safety factor should be 4:1. Tubing shall be clamped to avoid vibration and movement.

4.5.4.1.2 Tubing support. Hydraulic tubing shall be supported from rigid structure by suitable cushioned steel tube clamps conforming to MS 21919, or by suitable multiple block-type clamps. Supports shall be placed as near as practicable to bends to minimize overhang of the tube. Recommended spacings between supports are shown in Table II, except that where tubes support fittings such as unions and tees, spacing should be reduced approximately 20%. Where tubes of different diameters are supported together, the smaller spacing distance shall be used. Provisions shall be made in support location to accommodate change in tubing length caused by expansion and contraction. In order to facilitate inspection and repair, tubing shall not be bundled together but separated by multiple tube block type supports.

TABLE II. Recommended tubing support spacing.

Nominal Tube OD (inches)	Maximum Length Between Support Centers (inches — measured along tube)
1/8	11-1/2
3/16	14
1/4	16
5/16	18
3/8	20
1/2	23
5/8	25-1/2
3/4	27-1/2
1	30
1-1/4	31-1/2
1-1/2	32-1/2

4.5.4.1.3 Tubing location. Hydraulic lines shall be located as remotely as practicable from engine exhaust stacks and manifolds, electrical lines, and insulating materials. Attempts should be made to locate hydraulic lines below the aforementioned to prevent fire from line leakage. Hydraulic drain and vent lines shall exhaust in areas where the fluid will not collect in pools within the structure, or be blown onto or near exhaust stacks, manifolds, or other sources of heat. Tubing shall be located so that damage will not occur due to missile or gun blast, being stepped on, used as handholds, or by manipulation of tools during maintenance. Components and lines shall be so located that easy accessibility for inspection, adjustment, and repair is possible.

4.5.4.1.4 Tubing flares and assembly. Tubing flares shall conform to MS 33584. When installing tube connections, care should be exercised to keep the wrench torque, to assemble each joint, within the limits specified in MS 21344.

4.5.4.1.5 Tubing bends. Bends shall be uniform and shall be in accordance with MS 33611.

4.5.4.1.6 Hydraulic lines. When two or more lines are attached to a hydraulic part, the lines shall be sufficiently different in diameter or position so as to prevent incorrect connection to the component during replacement.

4.5.4.1.7 Tubing clearance. Where tubing is supported to structure or other rigid members, a minimum clearance of 1/16 inch shall be maintained with such member. A minimum clearance of 1/4 inch shall be maintained with adjacent rigid structure or units In areas where relative motion of adjoining components exists, a minimum clearance of 1/4 inch shall be maintained under the most adverse conditions that will be encountered.

4.5.4.1.8 External tube connections. External male threaded tube connections shall conform to MS 33656 and MS 33657

4.5.4.1.9 Bosses. Internally threaded bosses for connecting fittings shall conform to MS 33649. Bosses shall be made deep enough to prevent damage to internal mechanism or restriction of fluid flow, should universal fittings be screwed too deeply into the bosses.

4.5.4.1.10 Welded joints. Welded joints shall be stress-relieved.

4.5 4.1.11 Mounting lightweight components. Standard lightweight parts such as check valves, which are not supplied with mounting holes and which do not require adjustment after installation, may be supported by tubing, provided a tube clamp is used as close as practicable on each side of the component. Nonstandard parts of similar weight and usage may be mounted in the same manner. Standard and nonstandard parts shall be controlled by MIL-STD-965.

4.5.4.1.12 Bonding. The hydraulic system components and lines shall be bonded to the vehicle in accordance with MIL-B-5087.

4.5.4.2 Reservoirs. When a hydraulic reservoir is used, the volume shall be (2) to three (3) times the rated gpm output of the pump(s) in the system. The reservoir shall be designed in such a manner as to prevent aeration of the hydraulic fluid. Return lines and pump suction lines shall be positioned to prevent air entrapment in the fluid. Baffles and screens shall be utilized to the extent necessary to allow

separation of any entrapped air and prevent entrance of aerated fluid into the pump inlet. An outlet shall be provided to drain the reservoir, preferably by gravity method. Access holes shall be designed for inspection and cleaning of the tank.

4.5.4.3 Heat exchanger. When hydraulic fluid temperatures exceed 185° F, a heat exchanger shall be installed for heat reduction. Provision for bypassing the heat exchanger during cold temperature operation shall be provided.

4.5.4.4 Accumulator. Accumulator(s) shall be provided, as required, to maintain system pressure, supply make-up fluid, for pressure and volume compensation, suppression of line pressure shocks, minimize pump ripple, etc. They shall be designed to a minimum of 5 times the system operating pressure and sized according to its primary use.

4.5.4.5 Pumps. The hydraulic pumps shall be selected such that their rated power is 50 percent above the power demand of the system

4.5.4.6 Hand pumps. Hand pumps shall be installed for system operation in the event of system failure.

4.5.4.7 Cylinders. Hydraulic cylinders employed to impart load positioning shall be of the double acting type to provide positive control in both directions.

4.5.4.8 Filters. Unless otherwise specified, micronic-type filters shall be provided in all hydraulic systems. Micronic filters, if installed, shall conform to the requirements of MIL-F-8815. Filter elements shall be the disposable (throwaway) depth-type unit. These filters shall be used to filter all circulating system fluid.

4.5.4.9 Seals. Packing shall conform to MIL-P-25732. MIL-G-5514 shall be used as a guide for packing installation. Seals shall be able to withstand temperatures in the range of −65° to 275° F.

4.5.5 Other considerations.

4.5.5.1 Hydraulic system. Hydraulic system shall be provided with vent plugs or valves to insure that the system is full of fluid before putting the system into operation. To vent any accumulation of trapped air in any system accessible watertraps, filters, and low-point drainage plug shall be provided. Disconnection of lines, loosening of tubing nuts or the use of external pressure source does not constitute proper system venting.

4.5.5.2 Emergency systems. The hydraulic system shall have designed into it an emergency hand pump and check valve circuit to operate the lift mechanism in the event of prime power failure.

4.5.5.3 Fail-safe mechanisms. Hydraulic systems designed to handle weapons shall have "fail-safe" devices such as hydraulic velocity fuses or counter-balance valves in positioning and lifting mechanisms.

4.5.5.4 Electrical. Electrical parts of the hydraulic system shall be designed to operate satisfactorily on the power requirements of 4.7.1. The parts shall be designed to operate under simultaneous extremes of temperature, fluid pressure, and voltage.

4.5.5.5 Function-adjustment screws. Function-adjustment screws, if used, shall be so designed and constructed as to maintain adjustment under all the required vibration and operation. It shall be possible to adjust and lock the adjustable screws with standard tools. Positive locking means such as safety wire, lock nuts or lock tabs shall be used.

4.5.5.6 Noise and vibration. Noise and vibration, caused by turbulence or cavitation in hydraulic equipment or by unbalanced moving parts, shall be minimized. Noise and vibration transmitted from other equipment shall also be minimized by proper selection and design of mountings, couplings, and similar parts. MIL-STD-740 should be used for shipboard equipment.

4.5.5.7 Leakage. The system shall be designed such that internal leakage will only allow 0.5 in/hr. maximum movement of lifting mechanisms with rated load.

4.6 Pneumatic equipment.

4.6.1 General. Pneumatic components shall be designed to conform to MIL-P-5518. Pneumatic hose shall conform to the requirements of MIL-H-8788 and MIL-F-8789.

4.6.2 Pneumatic system lubrication. The lubricant for pneumatic systems shall conform to the requirements of MIL-G-4343. No other lubricant or organic compound may be used in the pneumatic system or in any application where contamination of the pneumatic system is possible.

4.7 Electrical systems.

4.7.1 Power requirements. Power for equipment using electric motors shall conform to MIL-E-917 and power shall conform to MIL-STD-1399, Section 300. Both shipboard and shorebased equipment shall operate on Type I, 440 volt, three phase, 60 Hz power as defined by Section 300 of MIL-STD-1399. If necessary, the alternate voltage of 115VAC, single phase, may be used.

4.7.2 Main power switch. A main power switch shall be provided which opens and closes all input power leads to the equipment. The main power input to the equipment shall be provided with suitable fuses or circuit breakers on the equipment side of the main power switch, to protect the power source from short-circuits or overloads within the equipment.

4.7.3 Overload protection. Protective devices shall be provided to prevent damage to the equipment caused by overload conditions and subsequent excessive heating of circuit components. Parts which are likely to carry an overload because of circuit malfunction, poor adjustment, or component casualty shall be capable of sustaining such an overload. Where this is impracticable, circuit breakers, relays, fuses, or other devices shall be included to protect the affected parts. A minimum number of secondary protective devices consistent with good engineering and safety practices shall be used.

4.7.3.1 Circuit breakers. Where circuit breakers are used, they shall be located in one main panel and be easily accessible to the operator.

4.7.3.2 Fuses Fuses shall be easily replaceable. Fuse ratings shall correspond closely to the parts they protect. Fuses shall open the circuit under short-circuit or overload conditions without emitting flame, molten metal, or vapor. One replacement fuse of each type and rating used shall be attached to the equipment in a convenient location.

4.7.4 Power plugs and receptacles. Portable equipment requiring external power shall be equipped with plugs and receptacles as indicated in 4.7.4.1.

4.7.4.1 Portable equipment using 115-volt, 60-cycle power. Portable shipboard equipment requiring 115-volt, 60-cycle power shall have a plug conforming to MIL-R-2726/38 Symbol 1218.3 for use in receptacles conforming to MIL-R-2726/37 Symbol 1099.1. Shorebased equipment shall be provided with a National Electric Code approved conventional three-prong ground plug.

4.7.4.2 Portable equipment using other power sources. If power other than 115-volts, 60 cycles is required for the portable equipment, the power supply cord plug shall be colored red, and a tag stating the type of power required shall be permanently attached to the cord. If the equipment will be damaged by power other than that specified, this fact shall be stated on the tag.

4.7.4.3 Portable equipment using receptacles. When receptacles are used in portable equipment, a tag shall be placed on the panel adjacent to the receptacle containing the same information required in 4.7.4.2.

4.7.5 Electrical bonding and grounding. Each piece of equipment used for handling AEODA shall be provided with adequate means for electrically bonding the load to the equipment. The continuity of the electrical bond shall be checked by attaching one lead of an accurate low-resistance ohmmeter to the outside ground and the other lead to the item. The meter reading should show continuity at a low resistance reading of not more than 10 ohms. Appropriate ground wire connections for all such portable or nonportable equipment shall be provided. Mobile equipment shall be provided with two replaceable, electrically conductive straps conforming to MIL-R-81090. The straps shall serve to discharge static electricity through their contact with the deck or road surface. For electrical bonding and grounding aboard ship MIL-STD-1310 shall be used.

4.8 Marking. Mobile and non-mobile equipment shall be marked in accordance with MIL-STD-130. Equipment, except cables and slings, shall be marked by means of a securely attached nameplate.

4.9 Environmental design. Except as noted below, equipment shall conform to MIL-STD-810 environmental conditions without detrimental effect on subsequent operation. Sand and dust tests, when required, shall be run on the affected components rather than the complete equipment. Salt, fog and humidity tests shall be run on the complete equipment.

4.9.1 Temperature. The Navy operating shipboard temperature requirements shall be between −20° F (low) to 140° F (high). For additional temperature requirements MIL-STD-810 should be used as specified by the procuring activity.

4.9.2 Fungus resistance. Those parts, which are susceptible to fungi, shall be subjected to a fungus test in accordance with MIL-STD-810, Method 508.1.

4.9.3 Altitude. The equipment shall be subjected to an altitude test in accordance with MIL-STD-810, Method 500.1, Procedure I.

4.9.4 Sand and dust. The function of operating parts shall not be impaired by exposure to the sand and dust test, method 510.1, of MIL-STD-810.

4.9.5 Salt atmosphere and humidity. Equipment shall function during and after exposure to the salt fog test, method 509.1 of MIL-STD-810. Minor corrosion affecting appearance only is not sufficient cause for disqualification.

4.9.6 Rain. Equipment shall operate properly after being tested in accordance with MIL-STD-810 Method 506.1. Procedure(s) shall be as specified by the procuring activity.

4.9.7 Reliability and Maintainability (R&M). A program for reliability and maintainability shall be developed as specified in the contract or order and approved by the procuring activity.

5. DETAILED REQUIREMENTS

5.1 Requirements for mobile equipment

5.1.1 General mobility requirements. Mobile equipment shall be designed to meet the mobility requirements and the pertinent tests contained in MIL-M-8090, as modified by this standard.

5.1.1.1 Mobility Index (MI) and Vehicle Cone Index (VCI). Mobility Index and Vehicle Cone Index shall be derived in accordance with DA Technical Manual, TM 5-330 (AFM-86-3, Vol II). The MI shall be as specified in the procurement for the specific equipment based on the off-road requirement of the vehicle.

5.1.2 Navy shorebase requirements. The Navy requirement to be used for mobile equipment is MIL-M-8090 Type I, class 1 or 2. All mobile equipment shall be designed to be air-transportable (loaded or unloaded) as indicated from its logistic use in accordance with MIL-A-8421. Loaded air-transportability is a requirement only when indicated from its logistic use. Air transportability limiting factors for US Air Force cargo aircraft are outlined in MIL-STD-1366 and MIL-HDBK-151. Mobile equipment that exceeds the air transportability limitations of MIL-STD-1366 requires air transportability analysis or test loading.

5.1.2.1 Ramp performance. Air-transportable equipment shall be capable of passing the ramp test specified in MIL-M-8090. Non-air-transportable equipment shall be capable of passing a similar ramp test, except the ramp angle shall be 17% (10°).

5.1.3 Shipboard requirements.

5.1.3.1 Stability. Vehicles shall be capable of operating on aircraft carriers under flight deck conditions (simple harmonic motion) of ±11 degrees in roll with an 18-second period and ±2 degrees in pitch with an 8-second period. Other shipboard equipment shall be designed to remain stable on 26% (15°) slope in loaded operating configuration. This stability requirement applies at any axis relative to the equipment. Stability shall be evaluated by the following procedures:

a. Place the loaded unit on a tiltable platform coated with a slip resistant deck covering in accordance with MIL-P-24441/1 (formula 150, a primer) and MIL-D-24483, Type I. The longitudinal axis shall be parallel to the edge of the platform which will act as a pivot.
b. Raise the opposite edge slowly until the platform makes an angle of 15° with the horizontal. Observe the results; then lower the platform.

c. Turn the equipment 15° about its vertical axis, and reraise the platform.
d. Repeat step (c) until 24 observations, each at a different angle, have been made.

Mobile equipment fails this test when any of the following occurs:

a. Vehicle upsets.
b. Brakes do not hold.
c. Equipment slides on platform.
d. Load slides relative to equipment.

5.1.3.2 Shock and vibration resistance.

5.1.3.2.1 High impact shock. When specified, shipboard handling equipment shall meet the high impact shock requirements of MIL-S-901, grade A.

5.1.3.2.2 Rolling shock. Shipboard equipment shall be designed to pass the following test without permanent deformation when loaded to rated capacity:

a. Roll the equipment along a smooth surface at a minimum design speed, i.e., 3.5 feet per second for class 1 mobility and 7.25 feet per second for class 2.
b. Roll the complete unit over a 2-inch vertical drop onto a hard surface.
c. Repeat this operation for a total of two times, once forward and once in reverse.

5.1.3.2.3 Impact shock. Handling equipment, such as dollies, designed for use in UNREP operations, shall pass the following tests when loaded as applicable:

a. Connected replenishment (CONREP)
   1. 18-inch flat drop without damage to equipment or weapon.
   2. 10-feet-per-second (min) impact against an unyielding surface on all four sides without damage to equipment or contents. (Minor structural damage to "bumpers" will not be cause for rejection.)
b. Vertical replenishment (VERTREP)
   1. 18-inch flat drop without damage to equipment or weapon.
   2. 5-feet-per-second (min) impact against an unyielding surface on all sides without damage to equipment or weapon. (Minor structural damage to "bumpers" will not be cause for rejection.)

NOTE:

Equipment designed for both CONREP and VERTREP shall pass the CONREP tests. Where connected transfer can predictably be confined to the use of the stream strongback and sliding padeye, impact velocity may be reduced to 7 feet per second.

5.1.3.3 Vibration resistance. Equipment developed for shipboard use shall meet the vibration requirements of MIL-STD-167-1.

5.1.3.4 Brakes. Mobile shipboard equipment shall include brakes designed on the dead-man principle so that the brake must be held off to move the equipment. Brakes shall be provided and must hold the loaded equipment motionless on a 15° slope. Brakes shall be capable of bringing the loaded equipment to a full stop within a distance of 12 inches on a dry, level, brush-finish, concrete surface, when moving at design rated speed (3.5 feet per second for class 1 and 7.25 feet per second for class 2). In special cases, depending on end use, the procuring service may increase or decrease the 15° general requirement and provide definitive design parameters and test and evaluation requirements. Brakes shall operate in a wet and saline atmosphere when tested in accordance with the salt fog test, method 509.1, of MIL-STD-810, for a 72-hour period.

5.1.3.5 Obstacle performance. When the equipment is to be operated on the flight deck of aircraft carriers, the standard 1-inch obstacle height required for Type I mobility shall be increased to 2 inches. Mobile vehicles designed for handling and loading weapons aboard ship shall be capable of traversing ramps to deck edge aircraft elevators and fire door sills on aircraft carriers. The requirement for door sills aboard aircraft carriers is 3 inches of rise with a 4° slope on each side of the sill.

5.1.4 Special mobility requirements. Three-wheel running gear configurations shall never be used for loaders or trailers. Trailer and loader center of gravity shall be located to optimize wheel ground pressure for steering and for traction. Casters may be used for shop and hangar equipment but shall not be utilized for flightline equipment.

5.1.4.1 Drive train systems. The following shall be typical parts for consideration in the design of each drive train system:

Mechanical	Hydrostatic	General (Used on both drive systems)
Clutch	Pump	Main gear box
Transmission	Motor	Universal joints
Speed reducer	Selector valves	Differential
Transfer box	Pressure reducing valves	Axles
Right angle drive	Heat exchanger	Wheels

5.1.4.1.1 Parts. The following shall apply to drive train components:

a. Trains shall assure the smooth delivery of energy to all motions, particularly in starting and stopping.
b. Weapons loader drive train components shall be designed and constructed of sufficient strength to meet detail design criteria.
c. The mechanical drive clutch shall be designed with the minimum working parts to be capable of transmitting the engine torque after clutch lock-up without any adverse heat effect.
d. The transmission in the mechanical drive system shall be of a fully synchromesh type. The shifting pattern of the transmission shall allow a positive change from one gear to another without interference from other gears.

e. Input and output shafts shall be sealed against lubricant leakage. Venting shall be provided and shall not cause expulsion of the lubricant under operating conditions. With the vent plugged, the gear box assembly shall not leak lubricant when stored in any position.
f. The hydrostatic drive train shall have provisions to disengage the wheels from the axles for towing purposes in the event of failure. Appropriate labeling instructions shall be provided to explain the disengage procedure.

5.1.4.1.2 Structural fuse. A structural fuse shall be incorporated into the design of the power train to limit the magnitude of the load that can be applied to the power train. The fuse shall be designed to fail before the maximum load of the weakest part of the power train is reached. However, this fuse shall in no way deter in the weapon loader's normal range of operation. The structural fuse shall be located for easy access and replacement.

5.1.4.2 Engines.

5.1.4.2.1 Self-contained power. Power sources for self-powered equipment may be electrical or internal combustion. Electric equipment to be used in magazine spaces or ready service lockers should be non-spark producing. Where the unit is intended to handle bulk high explosives or bag charges, the unit shall be explosion proof.

5.1.4.2.2 Internal combustion engines. Engines for vehicular use shall be selected from military or industrial sources, subject to the approval of the procuring activity. Power requirements for driven parts shall not exceed 75 percent of the available horsepower of the engine at operating RPM. The engine used for munitions handling vehicles shall be qualified by the applicable military specifications, and the engine supplier shall certify that the engine has been qualified. The engines used shall incorporate:

a. A flame arresting exhaust system.
b. A carburetor flame arrestor.
c. Devices to minimize exhaust emission pollutants.
d. Sufficient fuel and oil capacity to operate at least four hours without servicing
e. An operating time recorder.

5.1.4.2.3 Electric motor. Series wound, heavy duty, industrial type motors with a high starting torque shall be used. The motors shall be capable of withstanding the current load tests of MIL-STD-262. One or more thermal relay switches shall be provided to interrupt the current to an overheated circuit when the outside surface temperature of the motor exceeds 225° F. Forward and reverse speed controllers shall give smooth acceleration and shall include automatic means to prevent starting or reversing in other than first speed. Motors, controllers, relays, switches, and other electrical accessories that could be expected to arc or produce sparking during operation shall be the totally enclosed type.

5.1.4.3 Clutch. When a clutch is used, the force required to depress the clutch pedal shall not exceed forty pounds.

5.1 4.4 Engine exhaust system. The exhaust system shall be positioned and protected against entry of rain and shall have adequate drainage to prevent the accumulation of condensed vapors. The exhaust system shall provide for a spark arresting device. The exhaust system shall be mounted such that it will prevent burns to the operator and so that it will emit fumes away from the operator.

5.1.4.4.1 Muffler. The muffler shall conform to MIL-M-52590, and be capable of reducing overall exhaust noise to a maximum of 85 decibels (dB) at a radius of ten (10) feet from the end and two (2) feet above the muffler tail pipe with engine operating at rated load and speed.

5.1.4.4.2 Spark arrestor. The spark arrestor shall conform to the requirements of USDA Forest Service Standard 5100-1A, except for an increase of efficiency to 95 percent.

5.1 4.5 Electrical system The electrical system shall be negative ground and shall consist of an alternator and regulator, 12/24 volt battery, lights, switches, and necessary wiring. The nominal system voltage shall be 15/28 volts. The electrical system shall be adequately protected against overload by discriminate fuses or circuit breakers.

5.1 4.5.1 Alternator and regulator. The alternator shall be mounted externally on the engine and be capable of delivering more amperage than the system draws. The regulator shall be capable of maintaining voltage levels between 13 and 15 volts for 12 volt systems, and between 26 and 28 volts for 24 volt systems. The alternator and regulator system shall be protected from overload by an automatic disconnect circuit activated when an external power source is applied for emergency starting.

5.1.4.5.2 Battery. Batteries (except for battery powered equipment) shall conform to MIL-B-83769. The battery or battery circuit shall have quick-disconnect capabilities.

5.1.4.5.3 Lighting system. The lighting system of the equipment shall consist of running lights, stop and tail lights, blackout lights and spot or flood lights for loading at night.

5.1.4.5.4 Electromagnetic interference. Electromagnetic interference which is generated by powered and self-propelled equipment shall comply with the characteristics delineated in MIL-STD-461, MIL-STD-462, and MIL-STD-463. Radiation Hazard (RADHAZ) requirements shall conform to NAVAIR 16-1-529.

5.1.4.5.5 Blackout-running lights. The equipment shall have combination blackout-running lights on each of the four corners. When the blackout lights are in operation, stop and tail lights will not be operable.

5.1.4.5.6 Spot/flood light. The equipment shall be equipped with a swivel mounted spot or flood light, which can become portable, to facilitate night loading.

5.1.4.5.7 Switches Ignition and starter switches shall conform to MS 24523 and/or MS 24524. Light switches shall conform to MS 52128.

5.1.4.5.8 Wiring. Wiring used on loaders and trailers shall be made up in a harness configuration wherever possible. Wires shall be marked in accordance with MIL-STD-454 requirement No. 67. Wire shall conform to MIL-W-5086. Military Standard (MS) type terminal ends shall be used on all wire endings.

5.1.4.5.9 Lights. Running lights and directional signaling devices shall be installed on all off-base operated equipment. The incorporation of compatible provisions for equipment operated solely on-base and/or special provisions (spotlights, warning lights, etc.) shall be specifically delineated in the detail specification.

5.1.4.6 Brakes.

5.1.4.6.1 General requirements. All mobile equipment shall have brakes capable of restraining the handling equipment and its rated load on specified floor or deck conditions. For shorebased equipment, the service brakes shall be of the air, air-over-hydraulic or electric-hydraulic actuated type. For shipboard applications, mechanical brakes shall be used for skids and transporters, while loaders shall incorporate either mechanical or fluid as required. Except as specified herein, the brake requirements for all mobile equipment shall be in accordance with MIL-M-8090.

5.2 Examination and test conditions.

5.2.1 Conditions. Unless otherwise specified, all weapons handling equipment shall be tested or examined under the following conditions and in accordance with MIL-HDBK-151.

a.	Temperature:	77° ±18° F
b.	Humidity:	90 percent max. (relative)
c.	Barometric pressure:	Ambient

5.2.2 Product examination. The product shall be examined for conformance with applicable product specifications and drawings, with respect to performance functions. The product shall be operated with a load and shall demonstrate adherence to the design requirements. In addition, the product supporting or enclosing missiles or bombs shall be checked to mate with their respective surfaces without slippage, binding and interference.

5.2.3 Functional.

5.2.3.1 Rated load. The product shall be tested for not less than 5 minutes carrying the rated load. Equipment not at rest on a horizontal flat surface shall be securely mounted to a stationary apparatus, so that minimal movement is made during testing. During application of the rated load, inspect critical areas of the product to insure that no overstressing of parts has resulted. In addition, the tests shall conform to the design requirements of 4.4 or as required by applicable documents in Section 2

5.3 Special requirements — Trailers.

5.3.1 Product examination. Trailers shall be examined for conformance with applicable trailer specification and drawings, with respect to function and performance. The trailer shall be towed without a load and shall demonstrate forward and rear mobility including proper steering, brakes and tow bar functions.

5.3.2 Classification of requirements. Trailers designed under this standard shall be subjected to all tests listed with the exception of those tests which do not apply to the trailer as designed. The trailer tests requirements shall be classified as follows:

a. Product examination (see 5.4.1)
b. Functional requirement test (see 5.3.3)
c. Environmental requirements tests (see 5.3.4)

All testing shall be conducted with the rated load unless otherwise specified.

5.3.3 Functional.

5.3.3.1 Braking. On trailers provided with brakes, the following tests shall apply:

5.3.3.1.1 Parking brakes.

a. The parking brake shall be applied and the vehicle shall be subjected to a towing force sufficient to move the vehicle. The wheels containing the parking brakes shall skid and not roll on dry, level concrete.
b. The parking brake shall hold the fully loaded (rated load) vehicle motionless on a dry concrete incline of 20 percent (11.5°).

5.3.3.1.2 Service brakes.

a. The trailer, fully loaded, shall be towed at 20 mph on a level concrete surface and brought to a stop within 30 feet. The service brake shall operate smoothly and apply uniform braking action during this test. The trailer shall exhibit no tendency to jackknife.
b. The service brakes shall hold the trailer motionless and control it whether headed up or down an incline of 20 percent (11.5°).
c. Trailer service brakes shall be automatically applied in synchronization with the braking action of the towing vehicle.

5.3.3.1.3 Breakaway stopping. The brake system shall assure that, in the event the trailer is separated from the towing vehicle, the trailer service brakes will be automatically energized to stop the trailer in not more than 150 percent of tow vehicle/trailer stopping distance at rated capacity.

5.3.3.1.4 Back-up (if required). While the trailer is subjected to a back-up force, the service brakes shall momentarily hold, but with continued force shall release and allow unrestricted rearward travel.

5.3.3.1.5 Surge brakes. A trailer surge brake system, when used, shall provide smooth proportional braking action when the towing vehicle is decelerating on down-grades. The system shall have a bypass provision to permit the trailer to move rearward, with a maximum delay of one second after application of the rearward force.

5.3.3.1.6 Breakaway (if required). The trailer, fully loaded, shall be tested on dry level brushed concrete free of loose material, and shall be tested in the following manner: with the breakaway level of the surge brake positioned facing forward, the loaded trailer shall be subjected to a towing force sufficient to move the trailer for a minimum distance of 5 ft. to determine that the wheels will skid and not roll.

5.3.3.1.7 Inadvertent actuation. The surge brake actuator shall incorporate provision to prevent premature or intermittent brake action resulting from uneven road surfaces and/or trailer pitching.

5.3.3.2 Towing force. The trailer shall demonstrate capability to roll under a maximum towing force of 2-1/2 percent of its maximum gross weight. The prime mover shall apply a gradual towing force through a scale, which is placed between the prime mover and the towbar of the vehicle. The trailer shall be tested on a dry level concrete surface free of loose material and shall be fully loaded.

5.3.3.3 Design proof load. The trailer shall be subjected to a test load (Refer to Table I) with the trailer supported in such a manner that the load will not be carried by the tires. Evidence of permanent deformation shall be cause for rejection.

5.3.3.4 Mobility.

5.3.3.4.1 General See MIL-M-8090, paragraph 4.4. (Exclude 4.4.2.)

5.3.3.4.2 Special. See MIL-M-8090, paragraph 4.5.

5.3.4 Environmental. The trailer shall be subjected to all tests described in 5.4.4 except with the following addition: Equipment designed for fording shall be operated through water deep enough to submerge its running gear. The equipment shall remain in the water for 30 minutes, then removed and attached to a prime mover. The trailer shall then be towed at 15 mph and the brakes applied. The braking characteristics shall be noted.

5.4 Special requirements — Loader.

5.4.1 Product examination. The loader shall be examined for conformance with applicable loader specifications and drawings, with respect to functions and performance. The loader shall be operated with the rated load, and shall demonstrate forward and rear propulsion, steering, brakes, lift and incremental control, azimuth and incremental control, lateral, longitudinal, yaw, pitch, roll, side frame extension and operation of electrical switches. The boom motions are to be verified to coincide with their design limitations. It shall be determined that the weight of the loader does not exceed the specified maximum. The turning radius shall also be checked.

5.4.2 Classification of requirements. Loaders designed under this standard shall be subjected to all tests listed with the exception of those tests which do not apply to the loader as designed. The loader test requirements shall be classified as follows:

a. Product examination (see 5.4.1)
b. Functional requirement test (see 5.4.3)
c. Environmental requirement test (see 5.4.4)

All testing to satisfy requirements shall be conducted with the rated load unless otherwise specified.

5.4.3 Functional.

5.4.3.1 Lift rate.

5.4.3.1.1 Powered. The lifting mechanism shall be capable of lifting the rated load throughout the entire lift cycle at a controllable rate up to the maximum required.

5.4.3.1.2 Auxiliary. In case of a prime system failure, the auxiliary lifting mechanism shall demonstrate a maximum lifting time of one minute per every 16 inches of travel.

5.4.3.2 Accumulator (if required). The accumulator shall demonstrate its capability of being charged to capacity while the engine is running at the required rpm.

5.4.3.3 Fail-safe. The loader fail-safe device for the lifting mechanism shall be tested for holding in any given attitude during the entire lifting operations. This shall be accomplished by simulating some failure in the lifting mechanism and checking its ability to operate correctly.

5.4.3.4 Boom lifting and azimuth incremental control. The boom shall demonstrate both vertical and horizontal movement in 1/8 inch or less increments. Testing shall be accomplished for both movements at selected points of each range.

5.4.3.5 Cycle. The loader shall be subjected to a simulated loading condition comprising all boom and manipulator head movements, thus constituting one cycle. The cycle shall be repeated 250 times with the side rails, if any, fully extended. The tests shall be run at specified capacities and at normal operating speed.

5.4.3.6 Design proof load The loader shall be subjected to a test load (Refer to Table I) applied to the forks with the c.g. of the load in a normal weapon or store position and held there for 3 minutes. Evidence of yield in any of the components, which could in any manner prevent the loader from meeting operational requirements during service life, shall be reason to consider that the loader has failed this test. Due to the extreme load it is recommended that one axle be blocked at the wheels and the opposite end of the loader be tied down.

5.4.3.7 Mobility.

5.4.3.7.1 Road. The loader(s) shall be subjected to a road test of 50 miles over paved level surfaces, 25 miles loaded (rated load) and 25 miles unloaded. At the end of this test there shall be no evidence of damage or construction deficiencies. During the 25 miles loaded portion, a short stop to cool down the loader shall be allowed.

5.4.3.7.2 Side slope stability. The loader shall be tested for stability by demonstrating its ability to drive sideways on an 8 percent grade (4.5°). The loader side rails, if any, shall be extended for this test.

5.4.3.7.3 Brake. The brake test requirement is as follows.

5.4.3.7.3.1 Service brake. The service brake is to be tested for its capability to hold loader, fully loaded, without slippage on a 20 percent grade (11.5°), (shorebased equipment) or a 26 percent grade (15°) shipboard equipment. All tests to be done with loader facing both up and down the grade.

5.4.3.7.3.2 Parking brake. The parking brake shall be capable of holding the vehicle motionless on the following slopes, up and down:

a. Twenty percent (11.5°) slope with rated load for shorebased equipment.
b. Twenty-six percent (15°) slope with rated load for shipboard equipment.

5.4.3.7.3.3 Rapid braking. The service brake is to be applied in full force while the loader is travelling at top speed in a loaded condition. The brakes shall be capable of locking all four wheels in this test. Using a time distance recorder, the loader shall be brought to a complete stop from top speed and within the distance specified after brake application. For best results, this test shall be repeated three times. Failure to pass any one of these tests shall be cause for rejection.

5.4.3.8 Ramp negotiation. The loader shall demonstrate its capability of climbing a 10% (5.7°) grade loaded or a 20% (11.5°) grade unloaded. No point on the loader other than the wheels shall contact the ground or the ramp. The loader shall negotiate this grade under its own power. Failure to do so shall be cause for rejection.

5.4.3.9 Creep capability. The loader shall demonstrate smooth acceleration from a dead stop to a constant slow speed. Any evidence of surging or leaping shall be cause for rejection.

5.4.3.10 Speed. The loader shall be tested at top speed and must be capable of attaining its designed speed. This test shall be performed on a level, hard roadway, no less than 400 feet in length The loader shall be driven the entire 400 feet at top speed and timed at least twice.

5.4.4 Environmental. The general requirements specified in MIL-STD-810, except as noted, shall apply to the environmental tests specified herein.

5.4.4.1 High temperature. Unless otherwise required, the equipment is to be tested in accordance with MIL-STD-810, Method 501.1, Procedure II. The following detail requirements shall apply:

a. Pre-test data shall be required.
b. High storage and operating temperature shall meet the requirements of 4.9.1.

After tests, operate the equipment at room temperature.

5.4.4.1.1 Low temperature. Unless otherwise required, the equipment is to be tested in accordance with MIL-STD-810, Method 502.1, Procedure I. The following detail requirements shall apply:

a. Pre-test data shall be required.
b. Low storage and operating temperature shall meet the requirements of 4.9.1.

After tests, operate the equipment at room temperature.

5.4.4.2 Humidity. The equipment shall be subjected to a humidity test in accordance with MIL-STD-810, Method 507.1, Procedure I. The following detail requirements and exceptions to the test procedure shall apply:

a. Pre-test data shall be required.
b. The equipment shall be subjected to a performance check immediately after the completion of the tenth cycle, i.e., step 6 of the test procedure shall be eliminated.

After tests, operate the equipment at room temperature.

5.4.4.3 Salt fog. The equipment shall be subjected to a salt fog test in accordance with MIL-STD-810, Method 509.1, Procedure I.

5.4.4.4 Sand and dust. The equipment shall be subjected to a dust test in accordance with MIL-STD-810, Procedure I, Method 510.1. Upon completion of test, it shall be demonstrated that equipment performs satisfactorily.

5.4.4.5 Rain. The equipment shall be subjected to a rain test in accordance with MIL-STD-810, Method 506.1. Procedure(s) shall be as specified by procuring activity. Upon completion of test, it shall be demonstrated that equipment performs satisfactorily.

5.5 Special requirements — Trailers and Loaders.

5.5.1 Parking brakes. Parking brakes, when mechanical, shall be designed so that structural deflection of the vehicle, because of rated load dynamic conditions, will not actuate them.

5.5.1.1 Adjustment access. Adjustment of the mechanical brakes shall be possible without the removal or disassembly of any associated brake system components/related parts.

5.5.1.2 Force levels. The force levels required to energize the mechanical brake system shall be within the limits specified in MIL-STD-1472.

5.5.2 Towing provisions. A maximum of four trailers shall be capable of being towed in tandem. The drawbar shall swivel in the vertical plane and shall be equipped with a standard lunette eye, per MS 51336. The associated pintle assembly, conforming to MS 51335, shall be positioned from 14 to 21 inches above the static ground line.

5.5.2.1 Steering. The steering mechanism shall assure minimum differential tire wear. Sufficient mechanical advantage shall be provided through the drawbar to allow one man to manually steer the trailer under static full load conditions.

5.5.2.2 Automotive type steering. Methods shall be included for minute adjustment of parts that become misaligned because of wear. An access provision shall be made for lubrication. Means for adjusting the camber and toe-in of wheels shall be included.

5.5.2.3 Cramping stops. Stops shall be provided on the trailer chassis. They shall restrict the front wheel steering to a maximum cramping angle of 40° to each side of the center track. However, oversteer type designs are acceptable.

5.5.3 Fenders, mudflaps, and bumpers. Fenders, mudflaps, and bumpers shall not be provided for equipment, unless they are essential for protecting the item being handled. For equipment used in UNREP, bumpers shall be provided for weapon protection.

5.5.4 Controls. All controls for energizing armament handling motions shall be designed on the dead-man principle—handles, switches, etc. shall automatically neutralize in the absence of manual force.

5.5.5 Fuel servicing provisions — per MIL-T-46786.

5.5.5.1 Fuel tank construction and mounting. The fuel tank and filler neck shall be constructed to permit mounting in a location where damage from chafing against other equipment parts will not occur. Mounting attachments provided shall be of a type that will not loosen under operational vibration. When mounting straps are furnished, a barrier of fuel resistant material shall be provided to prevent chafing. The tank should be vented to the outside of the enclosure and shall be able to accept fuel without spill back from a fueling nozzle and a military 5 gallon fuel can. Spills or overflows should be directed overboard without the possibility of trapping or pocketing in or on the enclosure. During refueling, the fuel delivery nozzle or container shall not come in contact with any exposed electrical components of the tank or equipment. Metal fuel tanks shall be metal to metal contact with the frame or incorporate a ground strap to frame permitting discharge of static electricity.

5.5.5.2 Fuel tank components. A cap, chain, filler neck, strainer, shutoff valve and other necessary fittings shall be provided with each tank. The filler cap should be external to the enclosure to eliminate the necessity for an access door or plate. The cap shall be constructed of a material treated to resist corrosion, or a material inherently corrosion resistant. The cap shall be captive chained to the equipment. The chain shall not be connected to the fuel supply line, and shall be of sufficient size to inhibit loss of fuel cap. The filler neck shall be constructed of materials treated to resist corrosion, compatible with the fuel tank, and affixed to the tank in a manner compatible with the type of tank construction. The filler strainer shall be removable, constructed of non-corrosive material, 60 mesh screen, and shall be protected to prevent damage caused by contact with the refueling nozzle.

5.5.5.3 Fuel tank marking. The type fuel and fuel tank capacity shall be stenciled on the equipment adjacent to the filler cap. Material used for marking shall be compatible with the type of fuel being used.

5.6 Requirements for non-mobile equipment.

5.6.1 Hoist cable guides. Hoists employing wire rope as the load carrying medium shall incorporate adequate guides, fairleads, and/or feed devices to prevent snarling or entanglement of cable during reeling operations.

5.6.2 Hydraulic lifting or hoisting mechanisms. Mechanical locking capabilities shall be provided on any hydraulic lifting or hoisting mechanism which is intended (or might be used) to hold the load in the raised or extended position for more than 2 minutes. This locking capability shall be designed to satisfy 4.5.5.7.

5.6.3 Positioning and stabilizing load. Where a load must be lifted into close quarters or onto precise mating, provisions shall be made for final adjustment in aligning, mounting, and stabilizing the load while the ship is in conditions of roll and pitch. When testing the complete unit for hoisting safety, these means should be locked out unless their failure would permit the load to fall. When systems handling equipment are operated through the trunk or hatch of a ship, guides shall be provided for lateral restraint. This does not apply if the operations will never be conducted under conditions of more than 3° roll or list.

5.7 Special requirements — boom-type hoist.

5.7.1 Product examination. Each hoist shall be inspected for strict conformance to the pertinent drawings and specifications with respect to function and performance, especially rated capacity, elevation, extension and rotation requirements.

5.7.2 Classification of requirements. Hoists designed under this standard shall be subjected to all tests listed with the exception of those tests which do not apply to the hoist as designed. The hoist tests shall be classified as follows:

a. Product examination (see 5.4.1)
b. Functional requirement test (see 5.4.3)
c. Environmental requirement test (see 5.4.4)

All testing shall be conducted with the rated load unless otherwise specified. All tests shall include both powered and manual hoists, unless otherwise noted.

5.7.3 Functional requirements. During testing, hoist shall be securely mounted either to a vehicle or a stationary apparatus, so that minimal movement is made to the frame.

5.7.3.1 Rated load. With the hoist securely mounted, apply the rated load to the hoist. Inspect critical areas of the hoist to insure that no overstressing of parts has resulted from the test load.

5.7.3.1.1 Design proof load. A test load (Refer to Table I) shall be suspended by the hoist for three minutes in the same manner that the rated load is suspended during normal operation. No part of the hoist shall take a permanent set as a result of the test. After completion of the test, the hoist shall operate satisfactorily under power for six cycles and then manually for one cycle, raising and lowering the rated load the full distance. Upon completion of this test, destroy the cable and replace with a new cable.

5.7.3.1.2 Operating speed. The rated load shall be raised and lowered through the entire lift distance at an average specified speed. This test shall be conducted in the following sequence and shall be continuous:

a. Perform two (2) cycles manually, as required.
b. Perform twelve (12) cycles under power.
c. Perform ten (10) consecutive cycles by one man as required.

No malfunctioning of the hoist, such as skipping or jumping of the cable from the cable grooves, or uncontrolled lowering shall occur during this test. There shall be no evidence of damage after completion

of these tests. If manually operated, the effort to raise or lower the designed load shall not exceed 35 lbs. (17-1/2 lbs., per handcrank) on a radius of 8 inches.

5.7.3.1.3 Braking. While operating the hoist with the rated load the driving power shall be stopped. The load shall stop positively and smoothly, without slips or jerks, and be held without lowering. Upon resumption of operation, there shall be no interference in any part of the system, or slipping or jerky action due to a clutch, if any. The powered hoist brake test shall be accomplished two (2) times while operating the hoist manually and six (6) times while operating the hoist under power. For the manual hoist only, the brake test shall be accomplished four (4) times.

5.7.3.1.4 Cycle. The hoist shall be operated without failure or adjustment of parts through a total of 500 cycles. The rated load shall be raised and lowered the entire lift distance to constitute a cycle. The 500 cycles shall consist of segments of 20 consecutive cycles with a maximum 10 minute period of down time and repeated. After completion of the 500 cycles, the hoist shall be completely disassembled and inspected to determine whether any undue wear, fretting, scoring, etc. has occurred.

5.7.3.2 Components (if required).

5.7.3.2.1 Free-wheeling. If a hoist has a clutch or similar mechanism to allow free-wheeling of the cable drum to facilitate cable rigging, a maximum and minimum force to extract the cable shall be specified by the designer. This force shall be measured to insure compliance with the design requirements.

5.7.3.2.2 Safety overload device. The hoist shall have a mechanism by which overloading of the hoist on attaching structures is prevented. The force at which this device is activated (maximum and minimum) shall be specified by the designer. The mechanism shall be tested to insure compliance with the design limits.

5.7.3.3 Environmental. The hoist shall be subjected to all tests described in 5.4.4.

5.8 Special handling requirements.

5.8.1 Hoisting and tiedown fittings. Equipment weighing more than 150 pounds shall be provided with hoisting and tiedown fittings conforming to MIL-STD-209. In addition, if the equipment is to be delivered by parachute or touch-and-go, suspension and extraction provisions shall be provided in accordance with MIL-STD-814. For internal air transport MIL-A-8421 provides appropriate guidance for restraint of cargo. For external airlift, see Appendix D-6 of AR 70-47.

5.8.1.1 Single-point hoisting. Lifting devices shall be designed for single-point hoisting, wherever possible. Lifting devices for heavy aircraft ordnance may be multiple-point suspension to ensure compatibility with airplane attachments or to stabilize the load.

5.8.1.2 Location of single-point hoisting eye. The hoisting eye shall be placed directly above the center of gravity of the combined load. Where the unit has variable center of gravity locations, separate, clearly identified locations shall be provided for the hoisting eye. If, while the load is suspended, the center of gravity will be changed by work on the unit, a smooth-acting, simple means shall be provided for adjusting locations of the hoisting eye to level the load.

5.8.1.3 Size of hoisting eye. The inside diameter of hoisting eyes interfacing with cargo hooks, etc., shall be at least 3-1/2 inches. Hoisting eyes designed to interface with other equipment, such as aircraft or smaller hoists, may be correspondingly smaller or larger in accordance with MIL-STD-209.

5.8.2 Load attachments. All load attachments shall be as simply designed as possible, consistent with safety, and so that positive action is required to disengage them. Positive latches, spring-loaded safety hooks and spring-loaded or self-locking nut-bolt combinations in accordance with MIL-H-19253 shall be used on clevises.

5.8.3 Spreader bar slings. Spreader bars shall be used, if necessary, either to obtain clearance, or when load might be damaged by compression induced by angular suspension (particularly applicable to light structures of the type common in missiles). Minimum angle between spreader bar and member, leading to hoisting eye, shall be 30 degrees.

5.8.4 VERTREP slings. VERTREP slings and associated helicopter hookup gear shall be designed to provide a suitable insulator to avert grounding static electricity through hookup personnel. Layed rope is not acceptable. Provisions should be made to secure loose legs of a sling prior to takeoff to eliminate the hazard of entanglement. Chafe protection shall also be applied to the lifting rings (nylon) of hoisting slings.

5.8.5 Lifting beams. To reduce overhead clearance, consider lifting beams as an alternate to spreader bar slings. When designing lifting beams, particular attention shall be given to possible torsional failure.

5.9 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes

Custodians:
Navy — OS
Army — SM
Air Force — 99

Review activities:
Army — AR, SM, MI, MT
Navy — AS, EC, MC, SA, SH, YD
Air Force — 69
Other — DLA-DH

User activities:
Army — AL, AV

Preparing activity:
Navy — OS

(Project No. PACK-0598)

☆U.S. GOVERNMENT PRINTING OFFICE: 1981-703-023/5941

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

INSTRUCTIONS The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

DOCUMENT IDENTIFIER AND TITLE "General Design Criteria For Handling Equipment Associated With Weapons And Related Items"
MIL-STD-1365A

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A GIVE PARAGRAPH NUMBER AND WORDING

B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2 COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3 IS THE DOCUMENT RESTRICTIVE?

☐ YES ☐ NO *(If "Yes", in what way?)*

4 REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

TELEPHONE NO.

DATE

DD FORM 1426
1 JAN 72

REPLACES EDITION OF 1 JAN 68 WHICH MAY BE USED

S/N 0102-LF-014-1802

FOLD

DEPARTMENT OF THE NAVY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12900 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Commanding Officer
Naval Ordnance Station
Standardization/Documentation Division
Code 524
Indian Head, MD 20640

FOLD