INCH-POUND
MIL-E-17807C(SH)
12 February 1991
SUPERSEDING
MIL-E-17807B(SH)
26 June 1978
(See 6.7)

MILITARY SPECIFICATION

ELEVATOR, WEAPON AND CARGO, ELECTROMECHANICAL (SHIPBOARD)

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for the design, construction, and testing of electromechanical hoist rope operated elevators used to handle bombs, weapons, other explosives, and general cargo for shipboard applications.

1.2 Design philosophy. The design philosophy for the electromechanical elevators is to use the latest standardized construction techniques and to achieve reliability and maintenance levels in accordance with requirements specified herein.

1.3 General characteristics. Elevator is electric, winding drum type consisting of an electric motor drive and a platform lifted by means of wire rope winding on one or more drums. Elevator component requirements are as specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 3960

1.4 Classification. Electromechanical elevators covered by this specification are standard platform (see 3.5), four guide rail with four-wire rope suspension, with the control method and in the weight class specified (see 6.2).

Control method A - Relay logic.
Control method B - Static logic.

Weight class 1 - 6,000 pound rated load.
Weight class 2 - 12,000 pound rated load.
Weight class 3 - 16,000 pound rated load.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

L-S-300	- Sheeting and Tape, Reflective: Nonexposed Lens.
FF-B-171	- Bearings, Ball, Annular (General Purpose).
FF-B-185	- Bearing, Roller, Cylindrical; and Bearing, Roller, Self-Aligning.
FF-B-187	- Bearing, Roller, Tapered.
FF-B-195	- Bearing, Sleeve (Bronze, Plain or Flanged).
FF-S-85	- Screw, Cap, Slotted and Hexagon Head.
FF-S-86	- Screw, Cap, Socket-Head.
FF-S-92	- Screw, Machinery: Slotted, Cross-Recessed or Hexagon Head.
FF-S-200	- Setscrews: Hexagon Socket and Spline Socket, Headless.
FF-S-210	- Setscrews; Square Head (Inch) and Slotted Headless (Inch and Metric).
QQ-S-763	- Steel Bars, Wire, Shapes, and Forgings, Corrosion Resisting.
RR-W-410	- Wire Rope and Strand.
TT-P-645	- Primer, Paint, Zinc-Chromate, Alkyd Type.
GGG-P-781	- Puller, Mechanical Puller Attachment, Mechanical, and Puller Set, Mechanical.
PPP-F-320	- Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.

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 (Naval Shipboard Use).

MILITARY (Continued)

MIL-S-1222 - Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts.
MIL-L-2105 - Lubricating Oil, Gear, Multipurpose. (Metric)
MIL-C-2212 - Controllers, Electric Motor, A.C. or D.C., and Associated Switching Devices.
MIL-R-2765 - Rubber Sheet, Strip, Extruded, and Molded Shapes, Synthetic, Oil Resistant.
MIL-M-3184 - Machinery: Deck and Vehicle Mounted with Associated Equipment and Provisioned (Repair Parts) Items: Packaging of.
MIL-F-3541 - Fittings, Lubrication, General Specification for.
MIL-L-3661 - Lampholders, Indicator Lights, Indicator-Light Housings, and Indicator - Light Lenses, General Specifications for.
MIL-B-3990 - Bearings, Roller, Needle, Airframe, Antifriction.
MIL-C-5015 - Connectors, Electrical, Circular Threaded, AN Type, General Specification for.
MIL-B-5687 - Bearings, Sleeve, Washers, Thrust, Sintered, Metal Powder, Oil Impregnated, General Specification for.
MIL-S-6807 - Switch, Rotary, Selector Power, General Specification for.
MIL-S-8805 - Switches and Switch Assemblies, Sensitive and Push (Snap Action), General Specification for.
MIL-B-8942 - Bearings, Plain, TFE Lined, Self-Aligning.
MIL-B-8943 - Bearings, Sleeve, Plain and Flanged, TFE Lined.
MIL-B-8948 - Bearings, Plain, Rod End, TFE lined, Self-Aligning.
MIL-B-13506 - Bearing, Sleeve (Steel-Backed).
MS 15004 - Fittings, Lubrication (Hydraulic) Surface Check, 1/4-28 Taper Threads, Nickel-Copper Alloy, Type IV.
MS 15005 - Fittings, Lubrication, Throat or Surface Check, 1/8 Pipe Threads, Nickel-Copper Alloy Type V.
MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.
MIL-P-15024/5 - Plates, Identification.
MIL-E-15090 - Enamel, Equipment, Light-Gray (Formula No. 111).
MIL-F-15160 - Fuses: Instrument, Power, and Telephone.
DOD-P-15328 - Primer (Wash), Pretreatment (Formula No. 117 for Metals). (Metric)
MIL-S-16216 - Steel Plate, Alloy, Structural, High Yield Strength (HY-80 and HY-100).
MIL-T-16315 - Transformers, Power, Step-Down (Miscellaneous, Naval Shipboard Use).
MIL-B-16392 - Brakes, Magnet, Naval Shipboard.
MIL-M-17060 - Motors, 60-Hertz, Alternating Current, Integral-Horsepower, Shipboard Use.
MIL-C-17361 - Circuit Breakers, Air, Electric, Insulated Housing (Shipboard Use), General Specification for.
MIL-B-17380 - Bearing, Roller, Thrust.
MIL-P-17802 - Padlocks and Padlock Sets, Low Security, Key Operated, Regular (Open) shackle.

MILITARY (Continued)

MIL-S-18396 - Switches, Meter and Control, Naval Shipboard.
MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated.
MIL-E-21981 - Electronics Equipment, Nomenclature, Serial Numbers and Identification Plates: Requirements for.
MIL-S-22473 - Sealing, Locking, and Retaining Compounds: (Single-Component).
MIL-S-22698 - Steel Plate, Shapes and Bars, Weldable Ordinary Strength and Higher Strength; Structural.
MIL-P-23236 - Paint Coating Systems, Fuel and Salt Water Ballast Tanks. (Metric)
MIL-S-24093 - Steel Forgings, Carbon and Alloy Heat Treated.
MIL-P-24441 - Paint Epoxy-Polyamide General Specification for.
DOD-G-24508 - Grease, High performance, Multi-Purpose. (Metric)
MIL-C-24643 - Cable and Cord, Electrical, Low Smoke, for Shipboard Use, General Specification for.
MIL-S-24645 - Steel Plate, Sheet or Coil, Age-hardening Alloy, Structural, High Yield Strength (HSLA-80 and HSLA-100).
DOD-C-24667 - Coating System, Nonskid, for Roll or Spray Application. (Metric)
MIL-C-24707 - Castings, Ferrous, General Specification for.
MIL-C-24707/1 - Castings, Ferrous, for Machinery and Structural Applications.
MIL-C-24707/5 - Castings, Ductile Iron and Austenitic Ductile Iron.
MIL-S-24711 - Switch, Proximity, Solid State.
MIL-N-25027 - Nut, Self-Locking, 250°F, 450°F, and 800°F.
MIL-R-28750 - Relays, Solid State, General Specification for.
MIL-H-46855 - Human Engineering Requirements for Military Systems, Equipment and Facilities.
MIL-T-55164 - Terminal Boards, Molded, Barrier Screw and Stud Types, and Associated Accessories, General Specification for.
MIL-T-81714 - Terminal Junction System (TJS), Environment Resistant General Specification for.
MIL-T-81714/7 - Terminal Junction System, Terminal Junction Blocks, Sectional, Bussing Modules, Feedthru Type, Size 20, Series I.
MIL-T-81714/10 - Terminal Junction System, Rack Assembly, Track, Feedthru Type, Series I.
MIL-B-81793 - Bearings, Ball, Annular, for Instruments and Precision Rotating Components.

STANDARDS

FEDERAL

FED-STD-H28 - Screw-Thread Standards for Federal Services.
FED-STD-H28/2 - Screw-Thread Standards for Federal Services Section 2 Unified Inch Screw Threads - UN and UNR Thread Forms.

MILITARY

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-278 - Welding and Casting Standard.
MIL-STD-471 - Maintainability/Verification/Demonstration Evaluation.
MIL-STD-721 - Definitions of Terms for Reliability and Maintainability.
MIL-STD-740-1 - Airborne Sound Measurements and Acceptance Criteria of Shipboard Equipment.
MIL-STD-740-2 - Structureborne Vibratory Acceleration Measurements and Acceptance Criteria of Shipboard Equipment.
MIL-STD-781 - Reliability Testing for Engineering Development, Qualification and Production.
MIL-STD-1399 Section 300 - Interface Standard for Shipboard Systems, Section 300, Electric Power, Alternating Current. (Metric)
MIL-STD-1629 - Procedures for Performing a Failure Mode, Effects and Criticality Analysis.
MIL-STD-45662 - Calibration Systems Requirement.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

570-5225455 - Fork Truck Guards.
802-5773415 - Weapons/Cargo Elevator Slack Rope Safety Device Assembly and Details.
803-6397322 - Weapons/Cargo Elevator Platform Safety Linkage and Guide Roller System.
802-5773417 - Cargo/Weapons Elevator Overspeed Governor Assembly and Details.
803-5000999 - Personnel Barrier for Weapons Elevator.
803-5959252 - Hinged Hatch Piping Diagram.
803-5959253 - Horizontal Rolling Watertight Door Piping Diagram.
803-5959255 - Vertical Sliding Watertight Door (Up to Open) Piping Diagram.
803-5959256 - Standard Hydraulic Power Unit, Hydraulic and Electrical Schematics.
803-5959257 - Vertical Sliding Watertight Door (Down to Open) Piping Diagram.
803-5959259 - Roll-Up Hatch (with Operating Mechanism Above the Hatch) Piping Diagram.

DRAWINGS (Continued)
804-5184155 - Liferails.
805-1916300 - Tie Down Fittings.
9000-S6501-73801 - Call Signal Station, Type ICD W.T.

(Application for copies should be addressed to: Commander, Portsmouth Naval Shipyard, Naval Engineering Drawing Support Activity Code 202.2, Portsmouth, NH 03801-5000.)

DRAWINGS
NAVAL SEA SYSTEMS COMMAND (NAVSEA)
573-6723830 - Elevator Hybrid Relay Controller - Dual Hatch.
573-6723831 - Elevator Hybrid Relay Controller - Single Hatch.
573-6723832 - Elevator Hybrid Relay Controller - No Hatch.

(Application for copies should be addressed to: Commander, Naval Sea Systems Command, Code 56W4, Washington, DC 20362-5101.)

PUBLICATIONS
NAVAL SEA SYSTEMS COMMAND (NAVSEA)
0900-LP-008-2010 - Instruction for Design and Care of Wire Rope Installations.

(Application for copies should be addressed to the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)
390.03 - Gear Handbook Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears.

(Application for copies should be addressed to the American Gear Manufacturers Association, Inc., 1500 King St., Suite 201, Alexandria, VA 22314.)

AMERICAN IRON AND STEEL INSTITUTE (AISI)
Steel Products Manual

(Application for copies should be addressed to the American Iron and Steel Institute, 1133 15th St., N.W., Suite 300, Washington, DC 20005.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
A17.1 - Safety Code for Elevators and Escalators.
B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay). (DoD adopted)

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
SEC III - Boiler and Pressure Vessel Code, Section III, Rules for Construction of Nuclear Power Plant Components.

(Application for copies should be addressed to the American Society of Mechanical Engineers, 345 East 47th St. New York, NY 10017.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
A 216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service. (DoD adopted)
A 757 - Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing and Other Applications, for Low Temperature Service.
B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel. (DoD adopted)
F 1166 - Standard Practice for Human Engineering Design for Marine Systems, Equipment and Facilities.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)
SP10 - Near-White Blast Cleaning.

(Application for copies should be addressed to the Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.3.

3.2 Material and component. Material shall be as specified herein. Components that are in or supported by the Federal supply system shall be used to the fullest extent possible.

3.2.1 Brittle material. Magnesium or its alloys shall not be used. Brittle material is prohibited, except where the command or agency accepts its use for a particular application. Brittle material is material showing less than 10 percent elongation in 2 inches for the standard tensile test. For the static loading case (normal ship operation), brittle material is material being used below its nil ductility transition (NDT) temperature as measured by the Naval Research Laboratory (NRL) drop weight test. Charpy V-notch impact strength values may be used as criteria when these have been correlated with drop weight test results.

3.2.2 Aluminum. Aluminum alloys T-6061-T6 and 70XX-T6 shall not be used for load bearing fittings and components.

3.2.3 Steel plate. Steel plate shall be in accordance with MIL-S-22698 or MIL-S-16216.

3.2.4 Cast steel. Cast steel to be welded shall conform to MIL-C-24707 and MIL-C-24707/1 (grade WCA of ASTM A 216 or grade A1Q of ASTM A 757).

3.2.5 Forged steel. Forged steel to be welded shall conform to class H, type V of MIL-S-24093.

3.2.6 Asbestos. Asbestos shall not be used.

3.2.7 Cadmium plating. Cadmium plating shall not be used except where a particular application is approved by NAVSEA.

3.2.8 Fabrication, welding, and inspection. Fabrication, welding, and inspection shall be in accordance with MIL-STD-278, class M and class P for piping systems. Where practicable, welded steel construction shall be used in lieu of castings. Equipment exposed to the weather shall have continuous welds. The design shall eliminate pockets where water can collect.

3.2.9 Castings. Castings shall be nondestructively tested in accordance with MIL-STD-278.

3.2.10 Mercury. Mercury in any form shall not be used in shipboard equipment, including materials and parts thereof. Mercury shall not be used in manufacturing and test processes (including test equipment such as mercury indicators) applying to the basic equipment; but may be used in the manufacturing and test processes for materials and parts provided it is used in such a way that the materials and parts themselves cannot be contaminated. No instruments containing mercury shall be used in the manufacture or testing of any equipment destined for installation on a nuclear powered ship (see 6.3).

3.3 Design (see 6.3).

3.3.1 Weight. Special emphasis shall be placed on producing components which will have a minimum weight and require a minimum of space yet provide accessibility to maintain components in accordance with MIL-STD-1472. Materials such as laminates and resin or matrix composites may be used to achieve these goals, providing the materials have the required physical properties for the application and are approved by NAVSEA.

3.3.2 Storm seas. The elevator system shall withstand dynamic forces produced by motion of the ship in a seaway. Elevators shall hold the rated-load and maintain a static position under storm conditions and loading factors as specified (see 6.2).

3.3.3 Moderate sea conditions. The elevator system shall operate with rated-load and at rated-speed under the moderate sea conditions and loading factors or motion conditions as specified (see 6.2).

3.3.4 Temperature. Equipment installed in locations exposed to the weather shall operate satisfactorily throughout an ambient temperature range of minus 10 degrees Fahrenheit (°F) to plus 150°F. Equipment not exposed to the weather shall operate satisfactorily throughout an ambient temperature range of 32 to 120°F. Equipment shall operate in an atmosphere of relative humidity between 5 to 95 percent.

3.3.5 Life. The elevator shall not require replacement of component parts during a minimum life of 250,000 cycles at an operation rate of 16 cycles per hour for 10 hours per day. A cycle is a round trip between the extremes of the elevator hoist and lower range. Exceptions to part replacement requirements are the planned replacement type components such as the hoist ropes, brake linings, and relay contacts.

3.3.6 Manned rider prohibition. Elevators shall not require operators to ride the platform.

3.3.7 Fail safe. Elevator equipment shall be constructed for "fail-safe" operation. This is defined as the ability to maintain the safety of the weapon or cargo, equipment, and personnel at all times. Failure of the power source or manual or power-operated drive mechanism shall not result in damage to the weapon or cargo, or handling equipment, jeopardize the safety of personnel, or result in uncontrolled movement of the equipment and load. In event of power failure, the elevator shall be immobilized. "Fail-safe" shall not be applied to static components or to structural members or other static parts of mechanisms.

3.3.8 Lubrication fittings. Lubrication fittings in accordance with MS15004, MS15005, and types V, VI, and VIII of MIL-F-3541 shall be provided for bearing points not equipped with special lubrication means. Fittings shall be accessible for the use of a hand lubrication gun and shall utilize the same type and grade of lubricant. When installed onboard ship, equipment and machinery shall maintain satisfactory lubrication with no loss of lubricant under the storm sea conditions as specified (see 6.2).

3.3.9 Keyways. Where used, straight cut keyways in couplings and gear shaft shall be closed end to prevent loss of keys. Two keys 90 degrees apart shall be used at all couplings except that for the electric motor-gear reducer.

3.3.10 Bearings. Bearings meeting the physical, functional environmental, and service life requirements of the application shall conform to one or more of the following specifications.

FF-B-171	MIL-B-3990	MIL-B-8948
FF-B-185	MIL-B-5687	MIL-B-13506
FF-B-187	MIL-B-8942	MIL-B-17380
FF-B-195	MIL-B-8943	MIL-B-81793

Rotating anti-friction bearings shall be selected to result in an L-10 life of not less than 10,000 hours. Design shall be such as to permit the replacement of bearings with one of the tools contained in a Naval shipboard set of tools specified in GGG-P-781. No special tools shall be required. Special tools are defined as those tools not listed in the Federal Supply Catalog (copies of this

catalog may be consulted in the office of the Defense Contract Administration Services Management Area (DCASMA)). Brass or bronze bearing surfaces shall not be used in direct sliding or rolling contact with stainless steel, unless bushings are grooved and grease lubricated.

3.3.11 Screw threads. Screw threads, except as noted below, shall be unified national coarse 3A/3B fit in accordance with FED-STD-H28 and bolts and nuts shall be of the plastic insert, self-locking type. Class 3 fit shall be used for the setting end of studs and for special fitted work where thread interference is required and disassembly is unlikely. Thread locking compound in accordance with MIL-S-22473, grade CV (blue), shall be used for the settings of studs. Self locking nuts in accordance with MIL-N-25027 shall be used to hold down machinery and equipment to sub-bases and foundations. Bolts and studs for holding-down equipment to their foundations or sub-bases shall be installed in holes no greater than the following sizes:

Normal bolt diameter (inches)	Maximum diameter of hole (inches)
3/4 and smaller	Nominal bolt diameter plus 1/32
Larger than 3/4	Nominal bolt diameter plus 1/16

The above applies to clearance holes only. Where alignment must be maintained, fitted bolts or dowels shall be used (see 3.3.20). Sensor mountings and other non-critical components may use slotted holes for adjustment.

3.3.12 Threaded fasteners. Cap screws, machine screws, setscrews, bolts, and nuts shall comply with FF-S-85, FF-S-86, FF-S-92, FF-S-200 or FF-S-210, MIL-S-1222, and MIL-N-25027.

3.3.13 Thread protrusion. For a threaded fastener, not less than one thread but no more than four threads shall protrude beyond the crown of the nut. With plastic insert self-locking nuts, the end of the thread run-out shall be at least one thread above the top of the plastic insert. Washers shall not be used under the nut for the sole purpose of lessening thread protrusion.

3.3.14 Thread engagement strength. Thread engagement for the setting end of a stud shall be so that the shear load strength of the engaged threads is more than the tensile load strength of the stud.

3.3.15 Thread engagement dimensions. For materials having similar mechanical properties, the full thread engagement of studs shall be not less than 1 major diameter (ID). For materials having dissimilar mechanical properties, the minimum engagement of stud setting threads shall be computed in accordance with FED-STD-H28 and FED-STD-H28/2, appendix B, using the maximum tensile strength of the stud material and minimum specified tensile strength of the body material, plus one thread; but in no instance less than ID.

3.3.16 Bottom tapping. Bottom tapping is permissible only where metal thickness is insufficient for ID full thread engagement plus thread run-out and beveled end. Bottom-tapped holes shall have full threads for the entire depth.

3.3.17 Foundation bolts. Foundation bolt or studs shall comply with MIL-S-1222, grade 5, and shall be not less than 1/2 inch in diameter.

3.3.18 Through-bolting. Through-bolting shall be used wherever possible. Foundation bolting shall be installed so as to prevent the bolt from falling out due to vibration/gravity. However, bolts shall be replaceable without burning or welding. Where use of such bolting is not possible, studs, tap bolts, socket head, or machine screws shall be used. Fasteners shall be installed to permit ready access and removal in accordance with MIL-STD-1472.

3.3.19 Nuts. For foundation bolting, forged steel nuts shall be examined for defects in accordance with MIL-S-1222. Nuts machined from steel bars shall be only from stock found by magnetic analysis to have no seam depth outside the limits for cold finished bars in accordance with the AISI Steel Products Manual.

3.3.20 Foundation alignment. Foundation and bedplate hold-down, shear, alignment bolting, and dowelling shall be aligned and the holes reamed with the coupled parts in position. Where practicable, the shank of the bolt shall have definite interference with the metal surrounding the hole. Shear shall be through the body of the bolt, not through threaded portion. The fit shall be as specified in table I. The mating surfaces of the bolt and bolt hole shall have a surface no smoother than 63 micro-inches roughness height rating (RHR) in accordance with ANSI B46.1.

TABLE I. Fit limits for fitted hold-down bolting.

Nominal size (inches)	Maximum clearance (+) and interference (-), (inches)
1/2 to 1-1/8	+0.0005 -0.0010
1-1/4 to 1-7/8	+0.0006 -0.0013
2 to 3	+0.0007 -0.0016

3.3.21 Assembly of aluminum parts. Aluminum and aluminum alloy parts shall be assembled with steel bolts zinc-coated in accordance with ASTM B 633. This also applies to aluminum and aluminum alloy parts mounted on steel. Where the connection is exposed to moisture, bolts made of corrosion-resistant steel conforming to QQ-S-763 shall be used. Where through-bolting is not possible, corrosion-resistant steel inserts to take fasteners shall be turned into aluminum or aluminum alloy. Inserts shall be collar-, key-, pin-, ring-, or swag-locked, or nylon-element locked to prevent backing out. Solid wall, (bushing) type inserts shall be used. Helical, coil type inserts are excluded. Alloys of copper (brass, copper-nickel) shall not be used in threaded contact with aluminum or aluminum alloys. Washers of the same material and coating as the bolts and nuts shall be provided below all nuts and bolt heads which adjoin aluminum or aluminum alloys.

3.3.22 Sintered metal fasteners. The use of sintered metal fasteners is prohibited.

3.3.23 Thread locking compound. Where a thread-sealing or thread-locking compound is used, the material and its application shall comply with MIL-S-22473, grade CV (blue).

3.3.24 Lifting gear. Stationary machinery or components weighing in excess of 90 pounds shall be provided with padeyes, eyebolts, or equivalent means for attachment of lifting gear.

3.3.25 Shock. When specified (see 6.2), all elevator system components shall withstand exposure to grade A shock requirements of MIL-S-901 in the unloaded, stowed configuration.

3.3.26 Vibration. When specified (see 6.2), all elevator system components shall operate without degradation when subjected to the vibration requirements of MIL-STD-167-1, type I.

3.3.27 Explosion-proof. When specified (see 6.2), explosion proof equipment is required only for equipment which is located and confined in a space which may contain hypergolic fueled weapons or aviation gasolines.

3.3.28 Platform power take up devices. When air or electrical power is required on a platform, take-up devices shall be provided to keep the hoses and electric cables under control and functioning properly. Sheaves for electric cables shall have flat-bottomed grooves with loose fit.

3.3.29 Axis of rotation. Elevator systems shall allow rotating machinery to be installed with the axis of rotation as nearly horizontal to the baseline and parallel or perpendicular to the longitudinal centerline of the ship as practicable.

3.3.30 Noise. When specified (see 6.2), elevator systems shall meet the airborne noise requirements of MIL-STD-740-1. The contractor shall obtain measurements in accordance with the requirements, measurements, and data reporting procedures of MIL-STD-740-1. The equipment shall not exceed grade D airborne noise criteria of MIL-STD-740-1.

3.3.31 AFFF and JP-5 compatibility. All elevator system components shall be designed to withstand exposure to the weather, JP-5, seawater, and aqueous film-forming foam (AFFF).

3.3.32 Abrasives. All elevator system components shall withstand exposure to abrasives. Where the threat of exposure exists, provisions shall be made for flushing all rotating and pivoting points.

3.3.33 Paint overspray. All elevator system components shall be constructed to minimize damage due to indiscriminate spraying of Navy grade primers and paints.

3.3.34 Levels served. The elevator shall be constructed for stopping and being loaded at each deck level specified (see 6.2).

3.3.35 Doors and hatches. Doors and hatches shall be of the size and location as specified (see 6.2).

3.3.35.1 Damage control. All doors and hatches shall meet the watertight, ballistic and overpressure requirements as specified (see 6.2).

3.3.35.2 Operation. Doors and hatches shall be either hydraulically powered or manually operated as specified (see 6.2). Operation includes opening, closing, dogging, and latching. Manually operated doors shall be mechanically interlocked to prevent opening unless the platform is present at that level.

3.3.36 Human engineering. The principles of human engineering in MIL-H-46855 and MIL-STD-1472 shall be applied to all operations during design, manufacture, test, and installation and in the establishment of operational and maintenance instruction for the system, to minimize the possibility of degrading reliability through human error.

3.4 Factors of safety and maximum allowable stresses.

3.4.1 Definitions.

3.4.1.1 Rated load. Maximum load specified to be lifted (see 6.2) including the combination of:

(a) Weapon load (a weapon with its handling attachments, protective covers or shields, container, cradle, skid, pod, and so forth).
(b) Any additional equipment to be lifted which is not integral with the weapon load (slings, strongbacks, fork lift trucks, bi-rail hoists, and so forth.)

3.4.1.2 Operating design load. An equivalent load equal to the rated load plus the elevator platform weight plus the load imposed by the dynamic forces of the ship during elevator operating (moderate sea) conditions (see 6.2), plus the load due to acceleration or deceleration of the elevator.

3.4.1.3 Loading design load. An equivalent load equal to the rated load plus the elevator platform weight, plus the load imposed by additional handling equipment used to load the platform, plus the load imposed by the dynamic forces of the ship during platform loading in moderate sea conditions.

3.4.1.4 Stowed design load. An equivalent load equal to the elevator platform weight plus the load imposed by the dynamic forces of the ship during storm sea conditions (see 6.2), with the elevator in the stowed condition.

3.4.2 Wire rope. The factor of safety for wire rope shall be not less than 5, based on the ratio of the minimum breaking strength as specified in RR-W-410 to the operating design load. In cases where the equipment is required to move and support weapons at inclined angles, design consideration shall be based on the appropriate vector component of the operating design and holding design loads as applicable.

3.4.3 Hoisting machinery, platform, and structural parts. Calculated stresses shall conform to the following:

(a) Under equipment operating conditions, (operating design load), combined stresses, acting both individually and concurrently, for machine and structural components, shall be not greater than 35 percent of the yield point of the material in any part.
(b) The allowable combined stress for the hoisting machinery and structural components shall be not greater than 70 percent of the yield point of the material; when the platform has reached the extremity of its movement or is physically restrained against further movement; when subjected to under the maximum torque of the electric motor; or when subjected to the loading design load, whichever is greater.
(c) In stress calculations, the following strength relationship shall exist:

(1) Design:

Strength (working loads)	Percent of tensile yield point
Direct shear	60
Torsional Shear	65
Compression (bearing)	160

(2) Other values may be used if substantiated by test and accepted by the command or agency concerned.

(d) Parts subject to fatigue from cyclic stresses shall not exceed the maximum stresses specified for the required design life.

3.5 Platform.

3.5.1 Item definition. This item is an elevator platform suitable for raising and lowering cargo or weapons. The platform shall be a fabricated structure consisting of a frame and working deck surface.

3.5.2 Platform performance.

3.5.2.1 Platform capacity. The platform rated load capacity shall be selected from 3.11.2. The platform shall support the operating design load, loading design load, and stowed design load specified in paragraphs 3.4.1.2, 3.4.1.3, and 3.4.1.4. When considering the platform weight for the purpose of applying load factors, Navy standard hardware in accordance with NAVSEA 802-5773416 shall be assumed to be attached to each corner.

3.5.2.2 Loading design load. The platform shall support fork trucks and palletized loads as specified (see 6.2). The platform shall be capable of being loaded from both sides and ends. The effects of stopping fork truck shall be taken into account as part of load imposed by handling equipment.

3.5.2.3 Platform deck loading. The platform deck shall support a maximum wheel load of a loaded fork truck during moderate sea conditions. Possible load combinations and wheel foot prints are as specified (see 6.2). There shall be no change in physical properties of the platform deck due to fatigue after 250,000 cycles at an operating rate of 16 cycles per hour for 10 hours per day. One cycle is defined as a full loading or unloading evolution of the elevator.

3.5.3 Platform physical characteristics.

3.5.3.1 Weight and dimensions. The platform empty weight as delivered, including platform safety linkage and guide roller assemblies, shall not exceed the value as specified in 3.11.2. Platform dimensions shall be as specified (see 6.2). Depth of the platform structure shall be as shallow as practical and shall be not greater than 24 inches.

3.5.3.2 Deflection. The maximum structural deflections due to elastic deformation under the loading condition defined in 3.4.1.2 shall be not greater than the following values: 1/2 inch at center of platform, 1/4 inch at any edge. Under fork truck wheel loads the deck surface shall be permitted up to 1/8 inch deflection per foot between supports. Removable deck panels shall be designed to take the loading from one wheel of a loaded forktruck on the corner edge.

3.5.3.3 Hardware mounting surfaces. Allowance shall be made for installation of a mounting plate and one guide roller block for each guide rail in accordance with NAVSEA 802-5773416.

3.5.3.4 Platform safety linkage. The platform shall have safety linkage installed in accordance with NAVSEA 802-5773416. A channel of clear space shall be provided at each end of the platform for shafting to interconnect the safety roller assemblies on each corner. The clear area shall be between the corner mounting surfaces and shall not penetrate the mounting surfaces. Additional clearance, must be provided so that the shafting can be interconnected with wire rope. The safety linkage must be completely accessible from the underside of the platform for maintenance and replacement.

3.5.3.5 Buffer assemblies. Contact surfaces for elevator pit buffers shall be provided on the underside of the platform. The surfaces shall be coplaner. The contact surfaces shall be above the lower surface of the platform to the greatest extent possible to maximize the pit space available for the buffer assemblies. The underside of the platform shall provide sufficient clear space for the installation of the platform safety linkage and broken wire rope safety subsystem.

3.5.3.6 Platform surface. Platform surface shall be made of steel of sufficient strength and thickness to meet the requirements of 3.5.3.2 above. The platform surface shall be a slip resistant deck conforming to DOD-C-24667. A solid OSHA yellow border shall be provided around the perimeter of the platform. The border shall be 3 inches wide. Where wheeled dollies are used for the transfer of ordnance, the end margins shall be 5 inches wide. If ramps or some other bridging device is used for loading and unloading operations, the stripe shall be measured from the extent of ramp (see figure 5).

3.5.3.7 Platform tie down fittings. The platform deck shall be provided with tie down fittings for securing service loads. Tie down fittings shall be in accordance with NAVSEA 805-1916300(6), type I.

3.5.3.8 Liferails. The distance between the platform and the deck or trunk at all loading levels shall be not greater than 6 inches. Where trunk and platform dimensions differ more than this requirement, the gap shall be eliminated by a deck extension within the trunk. Where a deck extension is not possible due to door travel, liferails shall be installed in the trunk. Liferails shall be 42 inches tall with 14 inch horizontal spacing. Where neither a deck extension or trunk mounted liferails can be installed and gaps greater than 6 inches would result, platform mounted liferails shall be installed (reference NAVSEA 804-5184155). Platform mounted liferails shall be removable using flush wells in the platform. Liferail wells shall allow for drainage. Tolerances for well/stanchion interface shall prevent significant rocking of the toprail yet allow for easy installation and removal. Height of top liferail shall be a minimum of 42 inches above platform deck. Platform liferails shall be not greater than 4 inches inboard of platform edge and shall be as close to edge as is practicable. Platform mounted liferail stanchions and horizontal components shall be, as a minimum, 1-1/4 nominal pipe size, schedule 40, steel pipe.

3.5.3.9 Platform mounted switch vanes, Platform mounted cams and vanes shall be installed for operating the various trunk mounted control switches, and shall be adjustable vertically and horizontally in sufficient degree to encompass the overall operating tolerances of the elevator system. Cams and vanes shall be zero maintenance items unless ferrous material is required for switch actuation. Cams and vanes shall be easily adjustable from atop the platform in accordance with MIL-STD-1472.

3.5.3.10 Guide rollers. The platform shall have four guide roller assemblies installed in accordance with NAVSEA 803-6397322. Removable cover panels shall be provided to allow for maintenance of the guide roller assemblies.

3.6 Safety devices.

3.6.1 Application. Safety devices as specified herein shall be provided for all elevator installations. Linkages for the safety devices shall have positive action in both the operating and retracting direction of operation. Safety devices shall be readily accessible for examination, maintenance, repair, and test in accordance with MIL-STD-1472.

3.6.2 Broken rope safety device. When specified (see 6.2), elevators with configuration and strength to cause platform to wedge in trunk when ropes on one end or one side break do not require broken rope safety device. For all other elevators, the broken rope safety device shall be in accordance with NAVSEA 803-6397322 and shall operate so that:

(a) Breaking of any of the hoisting ropes shall cause the lever and shaft to activate the broken rope device and wedge knurled rollers against all guide rails to prevent further downward movement of the platform.
(b) Device shall automatically reset for normal elevator operation by raising the platform.

(c) Broken rope device and speed governor safety device shall each be a able to operate and wedge the knurled rollers independently of the other.

3.6.3 Overspeed governor. Overspeed governor in accordance with NAVSEA 802-5773417 shall operate in the event the elevator reaches a downward speed of 140 feet per minute (ft/min) (plus 10 ft/min, minus 0 ft/min) and shall comply with the following:

(a) Safety device shall operate an electrical switch to disconnect power from the electric motor and brake, which sets the brake.
(b) The governor rope shall be attached to the platform safety linkage in accordance with NAVSEA 802-5773416. When a winding drum governor is installed, means such as a spring loaded take-up sheave shall be installed to maintain overspeed governor wire rope tension between 30 and 60 pounds from the winding drum to the governor.
(c) Governor rope shall be 1/4-inch diameter, 6 x 37 (IWRC), stainless steel accordance with RR-W-410.
(d) Safety device shall automatically reset for normal elevator operation by raising the platform.
(e) Turnbuckles for adjusting the length of the rope shall be provided and be accessible from the top of platform.
(f) Governor shall be installed in machinery room unless impractical in which case it shall be easily accessible and protected from the weather. The platform and bolted watertight access covers are not considered easily accessible for governor maintenance.

3.6.4 Overspeed governor slack rope device. Overspeed governor slack rope device in accordance with NAVSEA 802-5773417 shall operate an electrical switch to disconnect power from the electric motor and brake and set the brake should the speed governor rope become slack or broken. The switch shall be positively actuated when the device is set. The slack rope device shall automatically reset for normal elevator operation when the rope becomes tight.

3.6.5 Hoisting rope-slack rope device. The hoisting rope-slack rope device in accordance with NAVSEA 802-5773415 shall operate an electrical switch to disconnect power from the electric motor and brake and set the brake should any hoisting rope become slack. The slack rope device shall automatically reset for normal elevator operation when the ropes become tight. The slack rope device shall be installed in machinery room unless another location is approved by NAVSEA.

3.7 Guide rails and rollers. Guide rails in accordance with ANSI A17.1 30-pound rails shall be used to guide the platform. Guide rails shall withstand the stopping of a fully loaded platform resulting from the application of safety devices and shall hold an empty platform under storm conditions as specified in 3.3.2 (see 6.2). Guide rails shall be of sufficient length to permit a minimum of 3 inches of overtravel at the top and bottom of elevator travel. Fixed stops shall be installed at the top of the guide rails and shall withstand the maximum attainable impact loads due to being struck by moving platform with rated load at rated speed or the load due to locked rotor torque, whichever is higher. Guide rails must be aligned from top to bottom to within plus or minus 1/8 inch center to center and face to face.

3.7.1 Application. Guide rollers in accordance with NAVSEA 802-5773416 shall be an adjustable spring-loaded type to allow for plus or minus 1/4 inch of side or end movement of the platform and for misalignment of the guide rails. One roller and safety shoe assembly shall operate on each rail, except two assemblies shall be provided to span any gaps which may be required for hatch cover installations.

3.8 Hoisting rope. Wire ropes for raising and lowering the platform shall be type I, class 3, independent wire rope core (IWRC), uncoated, extra improved plow steel, right regular lay in accordance with RR-W-410. Rope size for the elevator shall be selected as specified in 3.11.4.2.2 and have a maximum stretch of 1/2 inch between loaded and no-load condition at any level. Ropes shall permit the lowering of the platform to the fully compressed buffer and have remaining on the drum not less than 1-1/2 turns. Ropes shall be secured to the inside of the winding drums with dead-end clamps I as specified on figure 1. Means shall be provided to adjust the length of each rope individually by means of adjustment nuts on the platform end fittings. Platform end fitting adjustment nuts shall be accessible from alongside or from beneath the platform.

3.9 Buffer. Spring type buffer shall be furnished for installation in the elevator pit to absorb all the energy of the platform in the event of overtravel when traveling at full rated-load and over speed. The buffers shall have sufficient stroke to permit the platform to reach the positive stops without fully compressing the buffers.

3.10 Sheaves. Sheaves shall be provided to guide the hoisting ropes and speed governor rope. Depth, throat, rim thickness, neck, and groove diameters of sheaves shall be in accordance with NAVSEA 0900-LP-008-2010. Pitch diameter of sheaves shall be as large as practicable and in no case shall the diameter be less than 18 times the wire rope diameter. Sheaves shall be shrouded to keep the rope in place under all conditions and shall be mounted on anti-friction roller bearings. Sheaves shall be mounted to the foundations with fitted bolts.

3.11 Hoisting machinery.

3.11.1 Item definition. The hoisting machinery is an electric motor driven geared assembly for hauling in and paying out wire ropes connected through reeving to an elevator platform. The hoisting machinery shall safely raise and lower the loaded platform as well as braking it to a complete stop and holding the load from either direction of travel. The hoisting machinery assembly shall consist of the following major elements:

(a) Two-speed reversible electric motor.
(b) Triple reduction speed reducer.
(c) Hoisting wire rope drums.
(d) Overspeed governor wire rope drum (where required by in-trunk hatch).
(e) Spring set, electric release, disc brake.
(f) Main assembly bedplate.
(g) Drum shaft pillow blocks.
(h) Drum shafts.
(i) Couplings.

3.11.2 Hoisting machinery classes. The hoisting machinery shall be selected from the following classes as specified (see 6.2).

Class	Maximum rated load (pounds)	Maximum platform weight (pounds)	Minimum hoist capability (pounds)
1	6,000	5,000	15,000
2	12,000	7,500	26,000
3	16,000	10,000	35,000

3.11.3 Characteristics. The various machine elements shall be arranged in the configuration illustrated on figure 2 or figure 3. Provision for maintenance and lubrication of the machine elements shall be provided from the perimeter of the assembly opposite the hoisting rope drums. The assembly configuration which shall be subjected to the shock qualification test of MIL-S-901 shall conform to the specified machinery arrangement. The elevator platform which will be raised and lowered by the hoist machinery assembly will be supported by four wire ropes, single part reeving. In dispatch mode, the hoisting machinery will be energized to start in high speed and traverse in either the up or down direction to the desired deck level. A short distance from its destination the motor high speed windings will be deenergized and the low speed motor windings will be energized. Then, at the desired level, motor and brake voltage will be removed, the brake will set, and the hoisting machinery shall stop the elevator platform. In the manual or jog mode, the machinery will be energized in low speed only and traverse in the up or down direction while the jog button is depressed.

3.11.4 Performance. The hoisting machinery shall raise or lower the elevator platform while supporting its rated load. The total hoist capability of the machinery (platform weight, rated load and moderate sea factors) shall be as, specified in 3.11.2. Elevator high speed to travel shall be at 100 ft/min and low speed shall be at 16.7 ft/min. It shall start in high speed, decelerate to low speed up as it approaches its destination point, shortly followed by the braking mode. It shall have the capability of manual or jog operation as described in 3.11.3. It shall repeatedly perform as described when exposed to the duty cycle specified in 3.11.7.

3.11.4.1 Stopping capability.

3.11.4.1.1 Normal stop. The hoisting machinery shall stop a fully loaded platform travelling, in low speed, 16.7 ft/min, within 1/4 inch. The platform can be moving up or down and the stop shall be initiated by motor and brake voltage being removed by the controller.

3.11.4.1.2 High speed stop. The hoisting machinery shall bring a platform loaded with 150 percent of rated load at a speed of 100 ft/min in the downward direction to a full stop within 3 linear feet of travel after power is removed from the motor and brake.

3.11.4.2 Hoisting drums.

3.11.4.2.1 Drum arrangement. Hoisting drums shall be furnished suitable for winding four wire ropes. When two ropes are wound on a double drum, the two helical grooves shall be of opposite hand (see figure 4). The wire rope deadend

clamp shall be in accordance with figure 1. When a winding drum overspeed governor is required to allow operation with intermediate hatches, the overspeed governor drum shall be attached in accordance with figure 2 or 3.

3.11.4.2.2 Hoisting drum diameter. The hoist drum diameter shall be selected concurrently with the speed reducer ratio to allow the elevator to travel at 100 ft/min with motor input speed of 1700 revolutions per minute (r/min). The minimum drum pitch diameter shall be as follows:

Minimum drum pitch diameter (inches)	Rope diameter (inches)
22-1/2	3/4
30	1
33-3/4	1-1/8

3.11.4.2.3 Hoisting drum proportions. Drum width and groove proportions will be a function of the rope size specified for the elevator served and the platform travel. Rope storage capacity shall permit raising the platform to the positive stop position and lowering to the fully compressed down overtravel buffer position and have not less than 1-1/2 turns (dead wraps) remaining on the drum.

3.11.4.2.4 Hoisting drum configuration. The hoisting drums shall be grooved and of sufficient size to store the hoisting rope in one layer without rubbing of one part of wrap of rope against another. The maximum fleet angle between hoisting drum and sheaves shall be as small as practical and not greater than 2 degrees. The drums shall be proportioned in accordance with figure 4 and NAVSEA 0900-LP-008-2010. Pitch diameter tolerances for hoisting drums shall be held to a minimum. The maximum deviation in pitch diameter for the four drums shall be 0.006 inches. The wire rope shall be clamped to the drum in a manner that allows it to be adjustable for free length to permit platform leveling.

3.11.4.2.5 Overspeed governor drum. When a winding drum overspeed governor is installed, the overspeed governor drum shall have the same pitch diameter and tolerance as the hoisting drum and be grooved for 1/4-inch diameter wire rope. Rope storage capacity shall permit lowering the platform to the fully compressed bumper position and have not less than 1-1/2 turns (dead wraps) remaining on the drum. An overspeed governor drum shall be installed only when in-trunk hatches are specified (see 3.3.35).

3.11.4.3 Safety guards. All shafting, couplings and wire rope drums shall be furnished with guards which are of pipe and expanded metal construction. The guards shall permit visibility of components and allow easy removal. The expanded metal openings shall be small enough to keep fingers away from rotating parts. The spaces between the guards and rotating parts shall be sufficiently small to prevent inadvertent contact with rotating parts and pinch points.

3.11.4.4 Speed reducer. A single housing, triple reduction speed reducer shall be furnished. The reduction ratio shall allow the elevator speed to be 100 ft/min with the motor at full step which causes it's speed to be 1700 r/min. All mounting feet shall be within the outside dimensions of the assembly. The input pinion shaft shall be double extended so as to connect the motor on one side, and the brake on the other. The speed reducer case shall have a flange mount for the

brake. Provision for the brake mounting shall include an alignment pilot and a hole pattern for bolting. The output shaft shall also be double-extended to permit each shaft to drive a pair of hoisting drums. One side shall also drive the overspeed governor drum if a winding drum governor is required (see 3.11.4.2.5).

3.11.4.4.1 Gearing. The gearing shall be spur or helical, 20 degree pressure angle, capable of operation in either direction of rotation and shall have a quality number 7 or better in the American Gear Manufacturing Association (AGMA) rating system (see AGMA). The low speed shaft shall be capable of reacting 2000 pounds (lb) of axial thrust and 12,000 lb (class 1), 18,000 lb (class 2), 24,000 lb (class 3) of radial overhung load per side. The minimum service factor shall be 1.50. The gearing shall be totally enclosed in a single, oil tight case and shall be lubricated by oil bath. The gear case shall be constructed from ferrous material. The interior of the housing shall be coated with a permanent epoxy based primer in accordance with MIL-P-24441.

3.11.4.4.2 Housing. The housing shall permit the ready examination, repair, and removal of gears. A liberal number of inspection covers shall be provided so that all gears may be inspected without case disassembly. Bolts and nuts inside the gear case shall be lock wired. Gaskets shall be in accordance with MIL-R-2765. Shaft seal packing shall be replaceable without removing associated shaft.

3.11.4.4.3 Lubrication. Oil fill, drain, and vent fittings shall be provided. The filler holes shall have a 100-mesh strainer affixed with fasteners requiring hand tools for removal. Caps or covers shall be provided. A dipstick which indicates oil level shall be provided. The dipstick shall be marked to indicate the "full", and the "add oil" oil levels. The amount of oil to be added must be specified. The oil fill access to the dipstick shall be located on the gear case end opposite the output shaft end. Oil seals shall be provided to prevent leakage of oil where shafts penetrate the gear housing. All shafts shall be mounted on rolling element bearings. Bearings shall be fitted for high pressure grease lubrication, except those internal bearings which are oil lubricated. Proper and adequate circulation of oil through the bearings and gears must be provided under all operating conditions of pitch and roll. The reducer shall be oil-tight for non-operating inclinations up to 45 degrees of arc from the vertical. The reducer lubrication system shall be unimpaired while operating under pitch, roll, trim, and list conditions as specified (see 3.3.2).

3.11.4.4.4 Lubricants. When grease lubricated, a seal shall be provided to prevent the oil and grease for mixing. All grease fittings shall be arranged for access from the perimeter of the bedplate opposite the hoisting rope drums. Lubricating oil shall be in accordance with MIL-L-2105, grade 80W90. Grease requirements shall be consistent with DOD-G-24508.

3.11.4.5 Electric motor. An electric motor shall be furnished in accordance with MIL-M-17060 and the following requirements:

(a) Service: service A.
(b) Ambient temperature: 32 to 122°F (0 to 50 degrees Celsius (°C)).
(c) Ambient humidity: 95 percent at 90°F.

(d) Voltage: 440 volts alternating current (Vac).
(e) Phase: 3.
(f) Frequency: 60 hertz (Hz).
(g) Duty:

(1) Number of starts: 42 per hour.
(2) Time frame for one complete duty cycle:

a. Accelerate to high speed with an assisting overhauling torque of 150 foot-pounds (ft-lb) (class 1), 250 ft-lb (class 2), 330 ft-lb (class 3).
b. Run at high speed for approximately 5.7 seconds with an assisting overhauling torque of 150 ft-lb (class 1), 250 foot-pounds (class 2), 330 ft-lb (class 3).
c. Decelerate to low speed within 24 revolutions of the motor shaft with a resisting overhauling torque of 150 ft-lb (class 1), 250 ft-lb (class 2), 330 ft-lb (class 3).
d. Remove power and brake to a stop.
e. Pause for 75 seconds.
f. Reverse motor direction of rotation.
g. Accelerate to high speed with a resisting overhauling torque of 150 ft-lb (class 1), 250 ft-lb (class 2), 330 ft-lb (class 3).
h. Run at high speed for approximately 6.5 seconds with a resisting overhauling torque of 150 ft-lb (class 1), 250 ft-lb (class 2), 330 ft-lb (class 3).
i. Decelerate to low speed within 17 revolutions of the motor shaft with an assisting overhauling torque of 150 ft-lb (class 1), 250 ft-lb (class 2), 330 ft-lb (class 3).
j. Remove power and brake motor to a stop.
k. Pause for 75 seconds.

(3) The maximum periods and sequence of times the duty cycle will be imposed in a 24-hour period: continuous.
(4) Additionally, the motor shall be capable of running 10 minutes per hour in high speed and 10 minutes per hour in low speed.

(h) Connected inertia at shaft speed: 15 lb-ft^2 (class 1), 25 lb-ft^2 (class 2), 32 lb-ft^2 (class 3).
(i) Starting torque: 275 percent full load torque, minimum.
(j) Pull-out torque: 300 percent full load torque, minimum.
(k) Deceleration (transition) torque: 300 percent full load torque minimum.
(l) Full load torque 231 ft-lbs (class 1), 307 ft-lbs (class 2), 461 ft-lbs (class 3).
(m) Thermal protection;

(1) A minimum of three imbedded integral temperature detectors, located 120 ± 20 degrees apart.
(2) Temperature detectors shall be compatible with Power Control Corp. Navy Standard Thermal Motor Monitor and alarm system.

(n) Enclosure: dripproof, protected.
(o) Horsepower: 75 (class 1), 100 (class 2), 150 (class 3).
(p) Speed: two-speed (1800 r/min and 300 r/min).
(q) Type: squirrel cage induction.
(r) Design: D.
(s) Bearing type: ball.
(t) Conduit box location: to suit machinery layout.
(u) Insulation: class F sealed (vacuum pressure impregnation).
(v) Degree of balance: precision.
(w) Structureborne and airborne noise levels: in accordance with MIL-STD-740-1, grade D; MIL-STD-740-2, type 3.
(x) Locked rotor torque: not less than 180 percent of high speed full load torque.
(y) Capable of accelerating and decelerating as described in 3.11.4.5(g) above by applying 440 (±10 percent) Vac to the high or low speed windings, as applicable.

3.11.4.6 Brake. An electric brake shall be attached to the speed reducer high speed pinion shaft. The brake shall be of the disc type and shall be spring set and electrically released. It shall conform to MIL-B-16392 and the following requirements:

(a) Torque: The brake shall stop platform motion and machinery rotation, including deenergized motor rotor inertia, within a distance of 3 feet of platform downward travel at 100 ft/min when the platform is supporting 150 percent of rated load. Such a stop shall not be considered to be repeated in less than 2 hours.
(b) Supply voltage: 440 Vac, 3-phase, 60 Hz.
(c) Duty: 42 low speed stops per hour.
(d) Mounting: horizontal speed reducer high speed pinion shaft, flange.
(e) Enclosure: drip proof.
(f) Brake coil: class H insulation.
(g) The rotating brake discs shall be provided with heavy duty lining bonded to a bronze carrier ring. No asbestos shall be used.
(h) The stationary discs and pressure plate shall be nodular or ductile iron in accordance with MIL-C-24707/5.
(i) The brakes shall exhibit no failure modes other than wear when subjected to the heaviest duty cycle or when reset during high speed platform travel. A 2 hour cool down period is allowed after high speed stop.
(j) The brake overheating shall not cause damage other than brake lining wear.
(k) The brakes mounting surfaces shall retain their flatness within the original tolerances regardless of overheating and torque.
(l) The brake shall not be vulnerable to internal corrosion and shall never require internal anti-corrosion preservatives that could interfere with performance.
(m) The brake shall be designed to easily permit brake lining wear checks.
(n) The hold and release, forward and reverse, torque limitation of the brake shall be documented so that they can be measured by applying a torque wrench to the gear train.

(o) The brake shall be self adjusting.
(p) The brake shall meet grade A shock in accordance with MIL-S-901.
(q) The brake shall have a capacity to hold the platform while supporting the 200 percent static test load (400 percent for fork truck loading elevators).
(r) The brakes shall be easily cleanable so that dust resulting from brake wear shall not interfere with brake operation or reduce brake life when the brake is cleaned regularly.

3.11.4.7 Couplings. A flexible coupling shall be furnished between the electric motor and the speed reducer and between the speed reducer and the hoisting wire rope drums. The couplings shall be of the gear, all metal type. The use of a friction clutch or other non-positive type of drive is prohibited. Grease lubrication shall be provided by high pressure grease fittings and vents.

3.11.4.8 Hoisting drum shafting and bearings. Each hoisting drum shall be supported by a pedestal bearing on each side (see figures 2 and 3). The shafting shall be mounted in self-aligning, spherical roller bearings in accordance with FF-B-185, class 6. The outboard bearings shall be mounted to allow unrestricted axial expansion and contraction of the shaft. The inboard bearings shall be mounted to absorb thrust. All bearings shall be double shielded and shall be fitted with high pressure grease fittings and vents. Hoisting drum location shall suit the elevator layout. Shaft length will vary according to drum location.

3.11.4.9 Bedplate. The speed reducer and motor shall be mounted on a common bedplate. The bedplate shall be rigid enough to maintain alignment of machinery mounted thereon without aid from the deck foundation. Machinery mounting surfaces shall be completely machined. The bedplate shall be fabricated from steel in accordance with MIL-S-22698 or MIL-S-24645.

3.11.5 Physical characteristics. The hoisting machinery assembly shall be configured as depicted on figure 2 or figure 3.

3.11.6 Dimensional limitations. The hoisting machinery assembly shall not exceed the dimensional limits shown on figure 2 or figure 3.

3.11.7 Duty cycle. All elements of the hoisting machinery shall operate continuously with rated load and moderate sea factors without overheating or degradation of performance when subjected to the following duty cycle:

(a) Number of starts: 42 per hour.
(b) Time frame for one complete duty cycle: 100 ft/min down for 12 feet then 19 inches at slow speed with a 75 second wait and 100 ft/min up for 12 feet then 19 inches at slow speed with a 75 second wait.
(c) 24-hour period: continuous.
(d) Additionally, the machinery shall be capable of operating 10 minutes per hour in high speed and 10 minutes per hour at low speed.

3.12 General requirements for electrical equipment.

3.12.1 Electrical equipment. All major electrical equipment shall operate from a 440 Vac, 60 Hz, 3-phase ungrounded, type I power system having steady-state and transient characteristics in accordance with MIL-STD-1399, section 300. Electrical equipment shall be in accordance with MIL-E-917.

3.12.1.1 Cable. Cable shall be in accordance with MIL-C-24643. Cable from junction boxes or from the platform controller to proximity switch terminal leads shall be twisted pairs with each signal pair providing a zero total current supply and return within the same cable.

3.12.1.2 Cable connectors. Cable connectors shall be in accordance with MIL-C-5015.

3.12.1.3 Junction boxes. Junction boxes shall be provided as part of each control station to gain access to leads from logic, safety, and door switches for trouble shooting purposes.

3.12.1.4 Junction feed through. Feed through junction for controllers and control stations shall be in accordance with MIL-T-81714, MIL-T-81714/7, and MIL-T-81714/10.

3.12.1.5 Terminal strips. Terminal strips shall be in accordance with MIL-T-55164.

3.12.1.6 Wire markings. All wires inside controllers and junction boxes shall be permanently identified in accordance with MIL-E-21981 at each termination by wire markers of synthetic resin tubing or fiber tags. Markers shall identify cable number, wire number, and connection point.

3.13 Control system.

3.13.1 Control system components. The elevator control system shall consist of a motor controller, platform (logic) controller, dual hatch or hatch controller (required only for elevators with in-trunk hatches), machinery room control station, master control station, recessed control station (for elevators serving flight decks), main deck control station (for elevators serving hangar decks), deck level control stations and a power disconnect switch.

3.13.1.1 Motor controller. The motor controller shall be ac magnetic size 5 and shall control the motor and brake. The up, down, high speed, and slow speed contactors shall be mechanically and electrically interlocked so that up and down or high speed and slow speed cannot be activated simultaneously. The motor controller shall be located in the machinery room and shall be in accordance with NAVSEA 802-5773414 and MIL-C-2212.

3.13.1.2 Platform (logic) controller. The platform controller shall operate from 115 Vac power supplied from the motor controller and shall have an ungrounded 24 volt direct current (Vdc) power supply. The 24 Vdc high and power common shall be fused separately in accordance with MIL-F-15160. The platform controller shall be bulkhead mounted in the machinery room. The platform controller shall employ one of the following control methods as specified (see 6.2).

Method A - Hybrid relay logic.
Method B - Solid-state (static) logic.

3.13.1.2.1 Hybrid relay logic (method A). Hybrid relay logic controllers shall be provided as follows:

(a) Elevators with dual (two) hatches shall be in accordance with NAVSEA 573-6723830.
(b) Elevators with a single (one) hatch shall be in accordance with NAVSEA 573-6723831.
(c) Elevators with no hatches shall be in accordance with NAVSEA 573-6723832.

3.13.1.2.2 Solid-state (static) logic (method B). Solid-state logic platform controllers conform to the following requirements:

(a) Static logic controllers shall provide logic functions to command and control the sequence of elevator operation by means of solid-state components without the use of electromechanical relays. Capability to store control functions in a programmable memory is prohibited.
(b) The platform controller shall provide a visual monitoring system that will allow examination of the state of each input and output function of each static control element.
(c) A printed circuit board tester or test system shall be provided which shall be capable of testing all circuits on all printed circuit boards in the platform controller on a "go-no go" basis.
(d) Components or assemblies of the platform controller shall be installed in such a way as to permit replacement without requiring disassembly of other components or assemblies.
(e) The 24 Vdc power source in the platform controller shall be separate and isolated from other sources and shall not be used for any external functions outside of the elevator control system.
(f) Electromechanical contacts shall switch at a minimum of 5 volt amperes.
(g) The following equipment will operate from 24 Vdc:

(1) Pushbuttons used in command circuit with the logic control.
(2) Proximity switches used with the logic control.
(3) Solid-state components.
(4) Troubleshooting and other indicating lights associated with the logic control dc circuits.

(h) The platform controller indicator lights shall be 24 Vdc in accordance with MIL-C-2212 or MIL-L-3661.
(i) Test pushbuttons shall be in accordance with MIL-S-8805, and shall be momentary contact.
(j) All solid state relays shall be in accordance with MIL-R-28750.

3.13.1.3 Dual hatch or hatch controller. A dual hatch or hatch controller shall be incorporated into the control system of elevator having in-trunk automated or sequencing hatches. The dual hatch controller shall be in accordance with the appropriate NAVSEA drawing specified in paragraph 3.13.1.2.1. The dual hatch or hatch controller shall be located in the machinery room.

3.13.1.4 Machinery room control station. A machinery room control station in accordance with the appropriate NAVSEA drawing specified in paragraph 3.13.1.2.1 shall be provided in the machinery room separate from but adjacent to the motor and platform controllers.

3.13.1.5 Master control station. A master control station in accordance with the appropriate NAVSEA drawing specified in paragraph 3.13.1.2.1 shall be provided at the specified deck (see 6.2) in close proximity to the trunk access.

3.13.1.6 Main deck control station (aviation support ships only). Elevators serving the hangar deck shall be provided with a main deck control station in accordance with NAVSEA 573-6723830.

3.13.1.7 Recessed control station. When specified (see 6.2), elevators with flush deck hatches shall be provided with recessed control stations in close proximity to the elevator hatch. Recessed control stations shall be in accordance with NAVSEA 573-6723830.

3.13.1.8 Deck level control station. Deck level control stations are required at each level served (except where main deck, recessed, or master control stations are provided). The deck level control stations shall be located in close proximity to the trunk access and shall be in accordance with the appropriate NAVSEA drawing specified in paragraph 3.13.1.2.1. All control station elements shall be panel mounted within a lockable (by separate padlock) enclosure. Access to control stations shall not be blocked by opened doors or hatches.

3.13.1.9 Power disconnect switch. Each elevator control system shall be provided with a power disconnect switch, type NQB-A250, which shall incorporate a undervoltage safety circuit. The undervoltage safety circuit shall be connected so that when the undervoltage trip coil is deenergized by activating any emergency stop or high speed stop switch, the power disconnect switch shall open (trip) and disconnect 440 Vac power to the elevator control system. The power disconnect switch with undervoltage safety circuit shall be provided with a separate enclosure and shall be located in the machinery room adjacent to the machinery room access or near the master control station if there is no machinery room. A lockable enclosure shall be provided if the power disconnect switch cannot be located inside a lockable machinery room. A separate manual starter switch shall be provided adjacent to the power disconnect switch. The power disconnect switch and undervoltage safety circuit shall be in accordance with the appropriate NAVSEA drawing specified in paragraph 3.13.1.2.1 and MIL-C-17361.

3.13.2 Control system function. The control system shall function so that the elevator performs the following:

(a) Permits the motor to start and accelerate to high speed.
(b) Automatically transfers the motor from high to low speed.
(c) Automatically stops the platform within plus or minus 1/4 inch of the selected level when loaded or unloaded.
(d) Dispatch of the platform is possible only from the control station at the level where the platform is located as indicated by actuation of the slow and stop switches for that level.
(e) The platform is capable of being dispatched to any level served by the elevator.

(f) When the platform is dispatched to an intermediate level, all stop switches in the direction of travel beyond the destination act to bring the platform to a stop in case the switch at the registered level fails to do so.

(g) It is not possible for the platform to switch from high speed to low speed and back to high speed (high speed contactors being energized more than once) per single dispatch of elevator platform.

3.13.3 Control system design requirements. The control system shall operate on 440 Vac, 3-phase, 60 Hz, 3-wire, ungrounded power complying with the steady state and transient characteristics and ranges specified in DOD-STD-1399, section 300. Step down transformers shall provide the control system with 115 Vac and shall be in accordance with MIL-T-16315. Power supplies providing 24 Vdc shall operate from the 115 Vac power. Control power shall be fused separately on each side of the line in accordance with MIL-F-15160.

3.13.3.1 Control system safety features. Safety feature components and controls shall not be exposed to damage under normal operating conditions or be exposed to encourage possible tampering by operating personnel, where such tampering could lead to the defeat of the safety feature. The elevator control system shall be designed to operate with, control, and monitor all electrical safety features.

3.13.3.1.1 Up overtravel. An up overtravel limit switch shall be provided to prevent powered platform travel in the up direction past the terminal level up stop in the event of failure of any normal control system component to stop the elevator. Actuation of the up overtravel limit switch shall prevent both up and down motion and render all send pushbuttons inoperative. Jogging down in maintenance jog mode shall be the only means to move out of the overtravel position.

3.13.3.1.2 Down overtravel. A down overtravel limit switch shall be provided to prevent powered platform travel in the down direction past the terminal level down stop in the event of failure of any normal control system component to stop the elevator. Actuation of the down overtravel limit switch shall prevent both up and down motion and render all send pushbuttons inoperative. Jogging up shall be the only means to move out of the overtravel position.

3.13.3.1.3 Up travel limit. An up travel limit switch shall prevent the platform with a 6-foot high load from striking a closed hatch. Elevators which require a flush-deck hatch to operate (open/close) with platform movement shall stop the platform directly below the hatch travel limit and a hatch clear indicator on the control station at that deck shall illuminate. Depressing the hatch clear pushbutton shall open hatch and raise the platform flush to the deck.

3.13.3.1.4 Down travel limit. A down travel limit switch shall stop platform movement before striking a closed in-trunk hatch in the event any of the normal control components fail to open the hatch.

3.13.3.1.5 Overspeed governor. (See 3.6.3)

3.13.3.1.6 Overspeed governor slack rope device. (See 3.6.4)

3.13.3.1.7 Hoisting rope slack rope device. (See 3.6.5).

3.13.3.1.8 High speed stop. A high speed stop limit switch shall be provided just beyond the upper and lower terminal level slow switches to prevent platform from traveling in high speed into positive stops or a closed hatch due to a control system malfunction. The high speed stop switch shall be connected to the power disconnect switch undervoltage trip coil as specified in 3.13.1.9.

3.13.3.1.9 Door interlocks. Door electrical interlocks shall be provided as follows:

(a) Each door shall be interlocked to prevent it from being opened unless the platform is stopped at the corresponding door level. This interlock may be accomplished with a mechanical device if the door and its actuating system are designed to safely stall when operated against the interlock.
(b) Each door shall be interlocked to prevent elevator platform travel unless the door is fully closed and dogged.
(c) When more than one door is provided at any level, each door shall be interlocked so that only one door can be in the open position at any time.
(d) When specified (see 6.2), doors such as J-door and roller curtain type on elevators which trunks do not serve in a control function are not required to be interlocked. When doors are not interlocked, personnel safety barriers and an audible alarm are required (see 3.16.3 and 3.13.3.1.10).

3.13.3.1.10 Audible alarm. Elevators without interlocked doors shall be equipped with a platform motion warning bell or horn rated at 90 decibels (minimum). The warning bell or horn shall be energized whenever the platform is dispatched or jogged and shall remain energized as long as the platform is moving.

3.13.3.1.11 Emergency stop pushbuttons. Emergency stop pushbuttons shall be provided at each elevator machinery space control station. Additional emergency stop pushbuttons shall be installed in any portion of the machinery space with moving or rotating machinery not visible from the control station. Emergency stop pushbuttons shall also be installed in close proximity to the master control station on ships which operate with a closed trunk; and in close proximity to each deck level control station on ships that operate with open trunks or without a master control station. Actuation of an emergency stop pushbutton shall interrupt power to the undervoltage safety circuit trip coil causing the power disconnect switch to open deenergizing the elevator control system (see 3.13.1.9).

3.13.3.1.12 Emergency stow. All elevators with flush deck hatches serving a flight deck or hangar deck shall be provided with an emergency stow feature to allow an operator to close and dog the hatch without the operator remaining on station. An emergency stow pushbutton shall be provided at the control station with a red hinged cover labeled "E-stow". Actuation of the E-stow pushbutton shall cause the platform to return to sequence, stow position, or next lower level and the hatch to close and dog even if run/stop switches are in the stop position, except for the run/stop switch at the hatch control station with the E-stow pushbutton. At this station the E-stow shall not function with the run/stop switch in the stop position and this run/stop switch shall be capable of

interrupting the E-stow process. If the E-stow process is interrupted it shall not be possible to restart it without returning the run/stop switch to the run position and then actuating the E-stow pushbutton. E-stow shall override door interlocks but shall not override the hoisting or overspeed governor slack rope devices.

3.13.3.1.13 Fork truck guard circuits. Fork truck guards required at specified decks (see 6.2) shall operate off the deck level (slow-stop) switches. Each fork truck guard circuit shall be provided a circuit breaker in accordance with MIL-C-17361. Circuit breaker(s) shall be provided in a separate enclosure and shall be located adjacent to elevator access at levels where fork truck guards are required.

3.13.3.2 Run/stop switch. A run/stop selector switch shall be provided at each control station. When any switch is in the "stop" position, it shall not be possible to initiate or continue platform, door, or hatch motion except in the emergency stow (E-stow) mode.

3.13.3.3 Door control. Elevator powered doors shall be controlled by a three position, spring return to off (stop) rotary switch located in each control station at level with power doors.

3.13.3.4 Hatch control. Elevator powered hatch controls shall be capable of stopping hatch movement in both the open and closed direction. This requirement does not apply to in-trunk hatches which are not visible to the operator (see 3.3.35).

3.13.3.5 Bypass switch. The down overtravel and/or slack rope bypass/ normal/up overtravel bypass switch shall be a 3-position rotary detent switch in accordance with MIL-S-6807. In the event of a overtravel or slack rope condition, the bypass must be positioned to the corresponding direction and the jog selector switch must be in the maintenance jog mode; only then shall the platform be able to be jogged out of the overtravel or slack rope condition. The bypass switch shall interrupt 24 Vdc power to all dispatch pushbutton, disabling platform movement from any control station send pushbutton, while bypass selector switch is in either of the bypass positions.

3.13.3.6 Jog selector switch. The normal/deck level jog/ maintenance jog selector switch shall be a 3-position rotary detent switch in accordance with MIL-S-18396. Jogging shall be possible only in low speed and only when the jog selector switch is in one of the jog positions. When jogging in the deck level jog position, the low speed contactor shall be deenergized (stopping elevator platform movement) when platform reaches any deck level. When jogging in the maintenance jog position, the low speed contactor shall be deenergized (stopping elevator platform movement) when the platform reaches either terminal level. Jogging past a terminal level shall be possible only in the maintenance jog position while the bypass switch is in one of the bypass positions. The jog selector switch shall interrupt 24 Vdc power to the dispatch pushbuttons, disabling platform movement from any control station send pushbutton, while job selector switch is in either of the jog positions.

3.13.3.7 Safety interlock relay (SIR) circuit. The safety interlock relay (SIR) shall deenergize when the following switches or relays are opened or denergized:

(a) Local hydraulic pressure switch.
(b) Up overtravel proximity switch.
(c) Up travel limit proximity switch.
(d) Down overtravel proximity switch.
(e) Down travel limit proximity switch.
(f) Slack rope relays.
(g) Overload relay.
(h) Door relays.
(i) Run/stop relay.

The SIR shall remain energized for elevator operation. When the SIR deenergizes, the speed and directional contactors shall be deenergized (stopping platform movement), and the 24 Vdc power to the dispatch pushbuttons shall be interrupted disabling platform movement from any control station send pushbutton.

3.13.3.8 Deck level control. There shall be two (1 slow, 1 stop) deck level switches per elevator level, except at the upper and lower terminal level, stow level, and aircraft carrier ballistic decks where a duplicate slow switch is required. The down slow switch shall also function as the up stop and the down stop shall also function as the up slow switch. Both deck level switches (1 slow, 1 stop) shall be activated before the elevator can be dispatched.

3.13.3.9 Proximity switches. All switches (excluding high speed stop switches) shall be proximity type switches in accordance with MIL-S-24711.

3.13.3.9.1 Slow and stop proximity switches. The slow and stop switches shall be Dc-1.5-NONC proximity switches used in the normally open configuration. The duplicate slow switches shall be Dc-1.5-NONC proximity switches used in the normally closed configuration.

3.13.3.9.2 Overtravel and travel limit proximity switches. The up and down overtravel and travel limit switches shall be Ac-1.5-NC proximity switches.

3.13.3.9.3 Governor and slack rope device proximity switches. The overspeed governor, overspeed governor slack rope device, and hoist rope slack rope device switches shall be Ac-0.5-NC proximity switches.

3.13.3.9.4 Door interlock proximity switches. The door interlock switches shall be Ac-0.5-NO proximity switches. All other interlock switches shall be either Dc-0.5-NONC, Ac-0.5-NO, or Ac-0.5-NC proximity switches.

3.13.3.10 Mechanical limit switches. The high speed stop mechanical limit switches shall be in accordance with MIL-C-2212 and shall have the following characteristics (limit switch NSN 5930-00-391-4709 meets these requirements):

(a) Voltage rating: 115 volts, single phase.
(b) Location: Remote.
(c) Enclosure: Watertight and capable of withstanding repeated immersion in petroleum base or water glycol base hydraulic fluid, AFFF, and salt water. Explosion proof enclosures are required when specified (see 3.3.27 and 6.2).
(d) Contacts: Normally closed and normally open contacts electrically isolated from each other.
(e) Construction: Heavy duty with a 1-1/2 inch minimum roller diameter.
(f) Mounting: Mounted with cable entry upward into the switch bottom to prevent water intrusion.

3.13.3.11 Relays. All electro-mechanical and solid state relays shall be derated as follows:

Parameter	Max. percent of the related value
Contact current (continuous)	60 - Capacitive load 60 - Resistive load 40 - Inductive load 20 - Motor 10 - Filament
Contact current (surge)	80
Coil energize voltage	90 minimum
Coil dropout voltage	110 maximum
Vibration	75 (including Q of mounting)
Maximum derated ambient temperature	Limited to 65°C when rated @ 85°C 100°C when rated @ 125°C

3.14 Solenoids. Solenoids which are used to operate valves shall be rated for continuous energization and be of a design which can operate satisfactorily during prolonged periods of inrush current caused by slow solenoid movement. Solenoids shall be provided with individual fuses for their protection. Lockable covers or expanded metal cages shall be provided to prevent unauthorized personnel from manually operating the solenoid valves. Cages and covers shall use low security padlocks in accordance with MIL-P-17802. Cages shall have hinged doors and allow sufficient room for maintenance, removal, and installation of manifolds. Metal sheeting shall be attached to cages, if necessary, so that solenoid valves cannot be actuated through the expanded metal.

3.15 Communications. As a minimum elevators shall be equipped with sound powered magnetoringer communication stations in accordance with NAVSEA 9000-S6501-73801 at each control station immediately adjacent the control station, and in the machinery room immediately adjacent to the platform controller. If the platform controller is located remotely, the machinery room communication station shall be located adjacent the motor controller and another communication station is required adjacent the platform controller. The communication stations shall permit direct communications between all control stations and the machinery room. At weather deck control stations such as flight deck on aircraft carriers and in hypergolic magazines, only communication system phone jacks shall be installed.

3.16 Hydraulic system.

3.16.1 Function. The elevator hydraulic system consists of a power supply, actuators, and control valves as necessary for proper operation of elevator, doors, and hatches.

3.16.2 Hydraulic power unit. The elevator hydraulic power supply shall be in accordance with NAVSEA 803-5959256.

3.16.3 Door hydraulic circuits. Door hydraulic circuits shall be in accordance with NAVSEA 803-5959253, 803-5959255, 803-5959256, or 803-5959257.

3.16.4 Hatch hydraulic circuits. Hatch circuits shall be in accordance with NAVSEA 803-5959252 or 803-5959259.

3.16.5 Solenoid operated valves. Solenoid operated valves shall be of a type which can be manually operated for test purposes. Valves shall be located outside of the trunk where they are easily accessible for service.

3.17 Personnel safety barriers. Personnel safety barriers, when specified, shall be in accordance with NAVSEA 803-5000999 (see 6.2). Safety barrier netting shall be international safety orange. Personnel safety barriers are permitted only where elevator trunk serve no damage control function.

3.17.1 Platform absence warning. At each level where personnel barriers are installed across the elevator opening, reflective tape shall be used to provide an indication when the platform is not at the deck level. The tape shall be orange, 4-inches wide in accordance with L-S-300, type II, class 1. The tape shall be installed as a horizontal stripe below the deck level on all sides of the elevator trunk interior visible from the elevator opening. The tape shall be visible from the elevator opening when the elevator platform is not at the deck level. The tape shall be hidden from view when the elevator platform is at the deck level.

3.18 Fork truck guards. Fork truck guards, when specified (see 6.2), shall be in accordance with NAVSEA 570-5225455. Fork truck guards are required at each deck level served where fork trucks operate and interlocked doors are not installed.

3.19 Hatch stanchions. Hatch stanchions, when specified (see 6.2), shall be in accordance with NAVSEA 804-5184155. Stanchions and lifelines shall be installed around all elevator openings that cannot be protected by a door or personnel barrier.

3.20 Trunk lighting. Lighting at 30 inches above the periphery of elevator platform at each load level shall average 7 footcandles. All trunk lighting shall be fluorescent. Trunks shall be painted white except at weather deck openings where darken ship conditions require black. Lighting in machinery spaces shall average 10 footcandles.

3.21 Painting. If component specifications do not specify painting, the painting shall be as follows:

(a) External ferrous surfaces: one coat each of pretreatment DOD-P-15328, primer TT-P-645, and two finish coats MIL-E-15090, type II, class 2. Component finish coats shall be haze gray, except components in elevator trunks which shall be white.
(b) External aluminum surfaces: one coat each of pretreatment DOD-P-15328, primer TT-P-645, and two finish coats MIL-E-15090, class 2.
(c) Touch up of damaged paint shall be in accordance with (a) and (b) as appropriate.
(d) Bearing and machined surfaces, or interior "oil wetted" surfaces shall not be painted.
(e) Surfaces to be painted shall be completely free of rust, mill scale, dirt, oil, grease, moisture, deteriorated paint, and other surface contaminants. Coating shall be applied as soon as practicable after cleaning. Metal to be coated shall have surfaces prepared to "near-white" metal in accordance with SSPC SP10.
(f) External surfaces to be painted subject to leakage or spillage from a hydraulic system using fire resistant hydraulic fluid shall be coated with type 1, class 1, machinery gray paint in accordance with MIL-P-23236. Manufacturer's recommendations shall be followed for application.
(g) Corrosion resistant materials shall not be painted for the purpose of preservation.
(h) When painting in the area, switches, safety devices and label, warning, or operation plates shall be protected to prevent them from paint and overspray.

3.22 Lubrication and operating instruction charts. Lubrication and operating instruction charts shall be furnished for each elevator. Charts shall be in accordance with type F of MIL-P-15024 and MIL-P-15024/5.

3.22.1 Operating instruction chart. An operating instruction chart shall be provided for installation in each machinery room and elevator control station. Each chart shall give specific instructions for the operation of the elevator or control equipment in the room.

3.22.2 Lubrication charts. Lubrication charts shall be installed in each machinery room. Each chart shall fully indicate all points at which lubricants shall be applied, frequency of application, and designation of lubricant.

3.22.3 Safe working load warning. A 2-inch high safe working load warning, "SAFE WORKING LOAD xxx LBS", shall be provided on outside of each door and inside elevator trunk at each level. Warning can be placard, card, or stenciled.

3.22.4 No-rider warning. A 2-inch high warning, "KEEP OFF THIS ELEVATOR WHEN IN OPERATION" shall be provided on outside of each door and inside elevator trunk at each level. Warning can be a placard or may be stenciled.

3.23 Identification plates for product marking. Identification plates or other means of manufacturer's identification shall be affixed to components for proper identification to aid in replacements and repair parts. MIL-STD-130 shall be used as a guide. Identification plates shall withstand exposure to AFFF without loss of legibility or adhesion to equipment.

3.24 Reliability (see 6.3).

3.24.1 General definition. Reliability terms shall be defined according to MIL-STD-721.

3.24.2 Definition of failure. A system failure is defined as any event which necessitates corrective maintenance, including relevant and chargeable failures in accordance with MIL-STD-781, and level of severity in accordance with MIL-STD-1629. Chargeable failures include: any major or minor failures attributable to the internal operation of the system and system components. Failure due to external sources or operator error do not constitute chargeable failures.

3.24.3 Control system reliability requirements. The control system shall not require replacement of component parts during an MTBF of 3750 hours or 60,000 cycles at an operation rate of 16 cycles per hour for 10 hours a day. The cycle is defined as a round trip between the extremes of the elevator travel. Exceptions to part replacement requirements are the planned replacement type components such as contactor contacts.

3.24.4 Hoisting machinery reliability requirements. The hoisting machinery shall not require replacement of component parts during a mean cycles between failure (MCBF) of 250,000 cycles at an operation rate of 16 cycles per hour for 10 hours a day. The cycle is defined as a round trip between the extremes of the elevator travel. In this case, one way transit could require 60 linear feet of travel. Exceptions to part replacement requirements are the planned replacement type components such as brake discs.

3.25 Maintainability (see 6.3).

3.25.1 Definitions. Maintainability terms shall be defined in accordance with MIL-STD-721.

3.25.2 Maintainability requirement. Unless otherwise specified (see 6.2), the maximum mean-time-to-repair (MTTR) shall be 8 hours for all elevator subsystems.

3.26 System safety. Safety design features, including fail-safe features, shall be incorporated into the design to prevent damage to equipment and to ensure optimal personnel protection during operation, repair, or interchanging of any component or assembly (see 6.3).

3.27 Workmanship. Neatness, thoroughness and inspection of welding shall be in accordance with MIL-STD-278. Particular attention shall be given to neatness and thoroughness of marking of parts and subassemblies, support for electric cables, squareness and parallelism of butting joints, and absence of burrs and sharp corners on all parts.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program (see 6.3). The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) First article inspection (see 4.3).
(b) Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection of the elevator system components shall be performed prior to shipboard installation and shall consist of the tests specified in 4.3.1 through 4.3.7.

4.3.1 Overspeed governor bench test. The overspeed governor shall be mounted on a test bench and rotated to trip speed with the sheave ring attached to the sheave disc. The sheave ring shall then be detached from the sheave disc and a rope with a 30 pound weight on each end suspended over the sheave. The governor shall then again be rotated to trip speed. The trip speed shall not vary by more than one revolution per minute between the loaded and unloaded modes.

4.3.2 Electric motor test. The electric motor shall be operated on a dynamometer for 50 cycles in accordance with paragraph 3.11.4.5(g)(2). The motor shall accelerate and decelerate as specified when the voltage applied is 440 + 0, -10 Vac.

4.3.3 Hoist machinery shop test. The hoist machinery shall be connected to a test weight or other load producing device which can simulate the minimum hoist capability specified in 3.11.2.

4.3.3.1 Slow speed test. The hoist machinery shall be run through one cycle simulating complete elevator hoist and lower travel at slow speed with rated load on the platform.

4.3.3.2 Rated load test. The hoist machinery shall be operated through 10 cycles of hoist and lower travel at rated speed with a load simulating the platform plus rated load. The hoist machinery shall decelerate from high speed to slow speed within a rotation that correlates to no more than 19 inches of platform travel.

4.3.3.3 Dynamic load test. The hoist machinery shall be operated through 2 cycles of hoist and lower travel in maximum attainable speed with a load simulating the platform plus 150 percent of rated load. During this test the hoist machinery shall be deenergized while traveling downward at maximum attainable speed to set the brake. The hoist machinery shall come to a complete stop with the amount of rotation that correlates to 3 feet of platform travel.

4.3.4 Disconnect switch shop test. The disconnect switch shall be subjected to maximum motor current and the control voltage disconnected to demonstrate its capability to operate immediately regardless of motor current. This test shall be conducted separately from the dynamic load test.

4.3.5 Airborne noise test. The hoist machinery shall be tested under normal operating conditions to duplicate shipboard installation in accordance with MIL-STD-740-1.

4.3.6 High-impact shock tests. The components shall be tested for HI-shock in accordance with MIL-S-901.

4.3.7 Vibration tests. The components shall be tested for vibration in accordance with MIL-STD-167-1.

4.4 Quality conformance inspection. Quality conformance inspection of the installed elevator system offered for acceptance shall include the examination of 4.5 and the tests of 4.6 (see 6.3).

4.5 Quality conformance examination. The elevator system shall be examined for any defects jeopardizing the requirements of this specification and include the specific items of table II.

TABLE II. Classification of defects.

Major	Defect
101	Material not as specified.
102	Parts, components, or accessories incomplete, missing, or not as specified.
103	Misalignment of machinery or bedplate.
104	Assemblies and components not readily accessible for maintenance and repairs.
105	Casting not examined in accordance with the requirement of MIL-STD-278.

TABLE II. Classification of defects - Continued.

Major	Defect
106	Fabrication, welding, and examination for machinery not in accordance with class M of MIL-STD-278.
107	Welder and equipment qualification not in accordance with MIL-STD-278.
108	Parts hazardous to operating and maintenance personnel not fully enclosed, properly guarded, or insulated.
109	Drums not of specified dimensions or unable to contain the length and size of wire rope specified.
110	Hoisting machinery platform and accessories not provided with means for lubrication at readily accessible locations.
111	Linkages not operating smoothly and without lost motion.
112	Fasteners not secure.
113	Winch or platform components not as specified.
114	Direction of rotation incorrect for proper operation of safeties.
115	Controls not labeled, not illuminated or readily visible by operator.
116	Indicating lights not provided as required.
117	Gear reducer oil level capacity insufficient.
118	Mechanical safety device linkages not having a positive push pull action.
119	Each item of equipment not marked in a conspicuous manner on lubrication charts to indicate the grades of oils and greases used.
120	Identification markings, instruction, information, and warning plates incorrect, illegible, or missing.
121	Treatment and painting not as specified.
122	Workmanship not as specified.
123	Standard parts not being used where practicable.
124	Bearings not as specified.

4.6 Quality conformance tests.

4.6.1 Test procedures. After installation, the elevator system shall be tested for acceptable performance and for compliance with all the requirements in this specification. The tests shall be conducted in accordance with approved test plan. The Government reserves the right to have a representative witness to all such tests. All equipment devices and accessories necessary for conducting the test shall be furnished by the contractor.

4.6.2 Instrumentation and instrumentation records. Test instruments shall be accurately calibrated and of a sensitivity suitable for determining performance characteristics (see 6.3). Strip charts shall be properly identified, annotated and included with the test results. An oscillographic display shall be made for all dynamic tests. Test instruments shall be calibrated in accordance with MIL-STD-45662.

4.6.3 Major parts. Examinations shall be conducted to determine that all of the following items conform to the specification and the size, type, and rating shown on the certified drawings/name plate:

(a) Motor.
(b) Speed reducer.
(c) Brake.
(d) Hoisting drums.
(e) Governor.
(f) Couplings.
(g) Pillow blocks.
(h) Shafts.
(i) Bedplate.
(j) Motor controller.
(k) Platform controller.
(l) Machinery room control station.
(m) Master control station.
(n) Deck level control station.
(o) Mechanical limit switches.
(p) Proximity switches.
(q) Disconnect switch.

4.6.4 *Completed equipment.*

(a) Examination of the completed equipment shall be conducted to determine that all parts and components are oriented and mounted as illustrated on the certified drawing.
(b) All parts which require servicing, repair, replacement or periodic adjustment during the life of the equipment are readily accessible.
(c) All parts and components are marked with identifying symbols and these agree with those used on the certified drawing.
(d) All electrical terminations are located and identified in accordance with the certified drawing.

4.6.5 Static load test. Elevator platform, hoisting machinery and sheaves shall be static tested as follows:

(a) For non-fork truck loaded elevators. Test by supporting a load of 200 percent of rated load centered on the platform for 10 minutes.
(b) For fork truck loaded elevators. Test by supporting a load of 300 percent of rated load at one end of platform and 100 percent of rated at the opposite end of platform simultaneously. After 10 minutes, the loads shall be switched and the equipment tested for 10 more minutes.

During these tests, no element of the equipment shall take a permanent set nor shall it experience degradation of any operating or control function as a result of the test. The brake shall hold the elevator platform and static load without slippage.

4.6.6 Mechanical safety device tests.

4.6.6.1 Broken rope safety device test. Check that the undercar linkage operates to set the knurled rollers.

4.6.6.1.1 Actuation test. Lower the platform to the spring buffers to create a slack rope condition. If linkage operates to set knurled rollers the test is acceptable.

4.6.6.1.2 Reset test. Jog up to retension wire ropes. Verify that all linkage has retraced and that knurled rollers have returned to their housing pockets.

4.6.6.2 Overspeed governor, test 1. Check that tensioning the overspeed governor rope causes the under car linkage to operate to set the knurled rollers. Also check that the knurled roller mechanism will stop and hold an unloaded platform.

4.6.6.2.1 Test method. Attach a rope to the overspeed governor stop block. Lower the platform by slipping the brake and actuate the knurled roller linkage by manually pulling the rope attached to the overspeed governor stop block. If linkage operates to set knurled rollers and stops the platform with less than 1/4-inch per linear foot of tilt, the test is acceptable.

4.6.6.3 Overspeed governor slack rope device test. Create slack in the overspeed governor rope and verify that the platform cannot be dispatched up or down. Turn the slack rope BYPASS switch to BYPASS and verify that the platform can be jogged.

4.6.6.4 Overspeed governor, test 2. Check that operation of the overspeed governor will cause actuation of the undercar linkage and knurled rollers to stop and hold the platform when traveling with rated load at rated speed.

4.6.6.4.1 Perform test as follows:

(a) Ensure that overspeed governor will actuate between 140 and 150 ft/min. Seal governor adjust and tag governor with date of test.
(b) Attach actuating rope to overspeed governor stop block so that actuation will take place about five feet above lowest level.
(c) With rated load on platform, lower elevator at rated speed. Actuating rope will pull on overspeed governor stop block to actuate undercar linkage and knurled rollers.
(d) Inspect overspeed governor to determine if governor switch removed power from the hoisting motor and set brake.
(e) Inspect linkage to determine if knurled rollers set.

If linkage operates to set knurled rollers and stops and holds elevator with less than 1/4-inch per linear foot of tilt, and governor switch removes power from the hoisting motor and set brake, the test is acceptable.

4.6.7 No-load test. Elevator hoisting machinery and sheaves shall be operated through 25 complete cycles of hoist and lower operation through the full hoisting range at rated-speed with an unloaded platform. After completing the 25 cycles continue to operate the elevator with no load and verify proper operation of the following:

(a) All door closed and dogged interlocks.
(b) All hatch latched open interlocks (if applicable).
(c) All hatch closed interlocks and travel limits (if applicable).
(d) All run/stop switches.
(e) All E-stow switches (if applicable).
(f) All high speed stop switches (use installed test switch).
(g) Platform cannot be dispatched from level it is not at.
(h) Platform stops within 1/4 inch of each deck in both up and down travel.
(i) Audible alarm operates during travel (open trunk elevators only).
(j) All fork truck guards (open and close) (open trunk elevators only).
(k) Powered doors deadman controls.
(l) Powered hatch positive controls.

4.6.8 Slow speed test. Elevator hoisting machinery and sheaves shall be operated through one complete cycle of hoist and lower operation through the full hoisting range at slow speed with rated-load on the platform.

4.6.9 Dynamic load. Hoisting machinery and sheaves shall be operated through two complete cycles of hoist and lower operation through the full hoisting range at maximum attainable speed with 150 percent of rated-load on the platform. During this test, hoisting machinery shall be deenergized while traveling downward at full speed to set the brake. The platform shall travel no more than 3 feet after the hoisting machinery is deenergized.

4.6.10 Rated-load test. Elevator hoisting machinery and sheaves shall be operated through 10 complete cycles of hoist and lower operation through the full hoisting range at rated-speed with a load equal to rated-load on the platform. There shall be an 8-second stop at each limit of travel. After 10 cycles, operate through one cycle stopping at each level to verify that the platform stops within 1/4 inch of the deck.

4.6.11 Emergency stop test. Each "Emergency Stop" pushbutton switch shall be actuated to demonstrate proper operation of the power disconnect switch. At least one disconnect switch operation shall be performed while carrying full elevator motor current.

4.6.12 Emergency run test. Proper operation of the elevator shall be demonstrated by actuation of each "Emergency Run" pushbutton switch with the associated contact(s) of the overload relay(s) disabled.

4.6.13 Hoisting-rope slack rope device test. Lower the platform to the spring bumpers and check that the platform cannot be dispatched in either the up or down direction. Turn the SLACK CABLE BYPASS switch to the BYPASS position and jog the elevator back to deck level. Return system to normal condition.

4.6.14 Down overtravel switch test. Lower the platform close to but not on the spring bumpers and check that the platform cannot be dispatched in either the up or down direction. Turn the OVERTRAVEL BYPASS switch to the BYPASS position and verify that the elevator cannot be jogged down. Jog the elevator up to deck level. Return system to normal condition.

4.6.15 Up overtravel switch test. Attach a flag to the existing up overtravel. The temporary flag shall extend farther than the distance between the up stop switch and the up overtravel switch. Jog the elevator platform to the highest deck level. In order to pass the test, the platform must stop short of the highest deck level and not jog up when the OVERTRAVEL BYPASS switch is turned to BYPASS.

4.6.16 Reliability. A failure shall be as specified in 3.24.2 for reliability assurance testing purposes. The elevator control system and hoisting system shall be tested by one of the following reliability test procedures as specified (see 6.2 and 6.3).

(a) Test procedure I. The elevator shall be cycled continuously with rated-load, on the platform, at rated-speed without interruption by failure for 250 cycles. Each cycle shall consist of a hoist and lower operation with half cycle travel equal to the elevator's full hoist range. The elevator test cycle shall simulate the actual installation stop and speed sequencing, and hatch sequencing if applicable.

(b) Test procedure II. The same procedure as test procedure I except that a total number of test cycles shall be as specified (see 6.2). The last 250 test cycles shall be without failure.

(c) Test procedure III. The specified MCBF or MTBF requirement shall be demonstrated by the successful completion of a reliability test in accordance with MIL-STD-781. Applicable test level and test plan of MIL-STD-781 shall be as specified (see 6.2).

4.6.17 Maintainability. When specified (see 6.2), MTTR requirement of 3.25.2 shall be demonstrated by the successful completion of a maintainability demonstration in accordance with MIL-STD-471 (see 6.3).

4.6.18 Lighting measurements. Light meter readings shall be taken at 10 locations around the perimeter of rectangular platforms. The locations are a distance of one-third the platform width from each corner, at the midpoint of each long side, and at one-quarter of the length of each long side from each corner. For square or nearly square platforms light meter readings shall be taken at eight locations, each one-third of the platform length from each corner. All light meter readings shall be taken at a level of 30 inches above the platform, on the inside of the safety margin, pointed outward from the platform center and directed in the outer hemisphere to obtain the highest reading possible. Only one door shall be open during each reading except in the case of ships which operate with open trunks where one door and one hatch shall be open for the reading. The readings at each deck level shall average 7 foot-candles with no reading allowed to be less than 5 foot-candles.

4.7 Rejection. Failure of any elevator sub-system to pass any of the examinations or tests shall be cause for rejection.

4.8 Controls used for testing. Unless otherwise specified (see 6.2), elevator machinery controls used for testing shall be the same controls installed onboard ship.

4.9 Inspection of packaging. Sample packs and the inspection of the preservation, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.5.)

5.1 Packaging requirements. The packaging (preservation, packing and marking) requirements shall be in accordance with MIL-M-3184 for the level of preservation (A, C, or commercial); level of packing (A, B, C, or commercial), marking including packaging acquisitioning options therein as specified (see 6.2). In addition, the following applies:

(a) Navy shipboard stowage fire-retardant requirements.

(1) Treated lumber and plywood. When specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping containers and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B - Type II - weather resistant.
Category 1 - general use.
Level C - Type I - non-weather resistant.
Category 1 - general use.

(2) Fiberboard. When specified (see 6.2), fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flame spread index and specific optic density requirements of PPP-F-320 and amendment thereto.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. It is intended that this specification be used for reference in Ship Specification and for direct reference in contracts or orders for elevators. The intent is to set forth the conditions within which the equipment must operate satisfactorily and reliably.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of this specification.
(b) Elevator control method and weight class (see 1.4).
(c) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
(d) When first article is required (see 3.1).
(e) Storm sea conditions and loading factors (see 3.3.2, 3.4.1.4, 3.7 and 3.3.8).
(f) Moderate sea conditions and load factors (see 3.3.3, 3.4.1.2, and 3.7).
(g) Shock requirement (see 3.3.25).
(h) Vibration requirement (see 3.3.26).
(i) Explosion proof equipment requirements (see 3.3.27 and 3.13.3.10(c)).
(j) Noise limit (see 3.3.30).
(k) Levels served (see 3.3.34).
(l) Size and location of doors and hatches (see 3.3.35).
(m) Door and hatch damage control requirements (see 3.3.35.1).
(n) Door and hatch operation manual or powered (see 3.3.35.2).
(o) Rated load (see 3.4.1.1).
(p) Fork truck wheel footprint (weight and dimensions) (see 3.5.2.2 and 3.5.2.3).
(q) Load weight and dimensions (see 3.5.2.2).
(r) Platform dimensions (see 3.5.3.1).
(s) Platform weight (see 3.5.3.1 and 3.11.2).
(t) Broken rope safety device waiver (see 3.6.2).
(u) Class of hoisting machinery (see 3.11.2).
(v) Method of control (see 3.13.1.2).
(w) Location of master control station (see 3.13.1.5).
(x) If recessed control stations are required (see 3.13.1.7).
(y) Door interlock requirement waiver (see 3.13.3.1.9(d)).
(z) For truck guard requirement and locations (see 3.13.3.1.13 and 3.18).
(aa) Personnel safety barrier requirement (see 3.17).
(bb) Hatch stanchion requirement (see 3.19).
(cc) MTTR is different from 8 hours (see 3.25.2).
(dd) Which reliability test procedure, if required (see 4.6.16).

(1) Number of repetitive cycles required if test procedure II is selected.
(2) Test level and plan required if test procedure III is selected.

(ee) If maintainability demonstration is required (see 4.6.17).
(ff) If controls are other than those onboard ship (see 4.8).
(gg) Level of preservation and packing and packaging options required (see 5.1).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.2.10 and 4.6.2	DI-MISC-80678	Certification/ data report	---
3.3 and appendix A	DI-DRPR-80651	Engineering drawings	Level 2
3.3 and appendix B	DI-GDRQ-80650	Design data and calculations	---
3.24	DI-R-7079	Reliability program plan	---
3.24	DI-R-7082	Reliability predictions report	---
3.24	DI-R-7086	Failure mode, effects, and criticality analysis plan	---
3.24	DI-R-7085	Failure mode, effects, and criticality analysis report	---
3.25	DI-MNTY-80822	Maintainability program plan	---
3.25	DI-R-2129	Plan, maintainability demonstration	---
3.26	DI-SAFT-80100	System safety program plan	---
3.26	DI-SAFT-80101	System safety hazard analysis report	---
3.26	DI-SAFT-80102	Safety assessment report	---
4.6.16	DI-RIEGI-80252	Reliability test reports	---

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
4.6.17	DI-MNTY-80832	Maintainability/Testability/Demonstration Test Report	---
4.3 and 4.4	DI-NDTI-80566	Test plan	---
4.4	DI-NDTI-80604	Test report	---

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first ___ production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.6 Subject term (key word) listing.

Audible alarm
Brake
Broken rope safety device
Buffer assemblies
Bypass switch
Control system
Deck level control station
Door interlocks
Down overtravel
Down travel limit
Electric motor
Emergency stop pushbutton
Emergency stow
Fork truck guards
Guide rails
Guide rollers

Hatch stanchions
High speed stop
Hoisting machinery
Hoisting machinery class
Hosting rope
Hoisting rope slack rope device
Hybrid relay logic (method A)
Jog selector switch
Loading design load
Machinery room control station
Main deck control station
Master control station
Motor controller
Operating design load
Overspeed governor
Overspeed governor slack rope device
Personnel safety barriers
Platform
Platform (logic) controller
Platform safety linkage
Power disconnect switch
Rated load
Recessed control station
Run/stop switch
Sheaves
Solid-state (static) logic (method B)
Speed reducer
Trunk lighting
Up overtravel
Up travel limit

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 3960-N004)

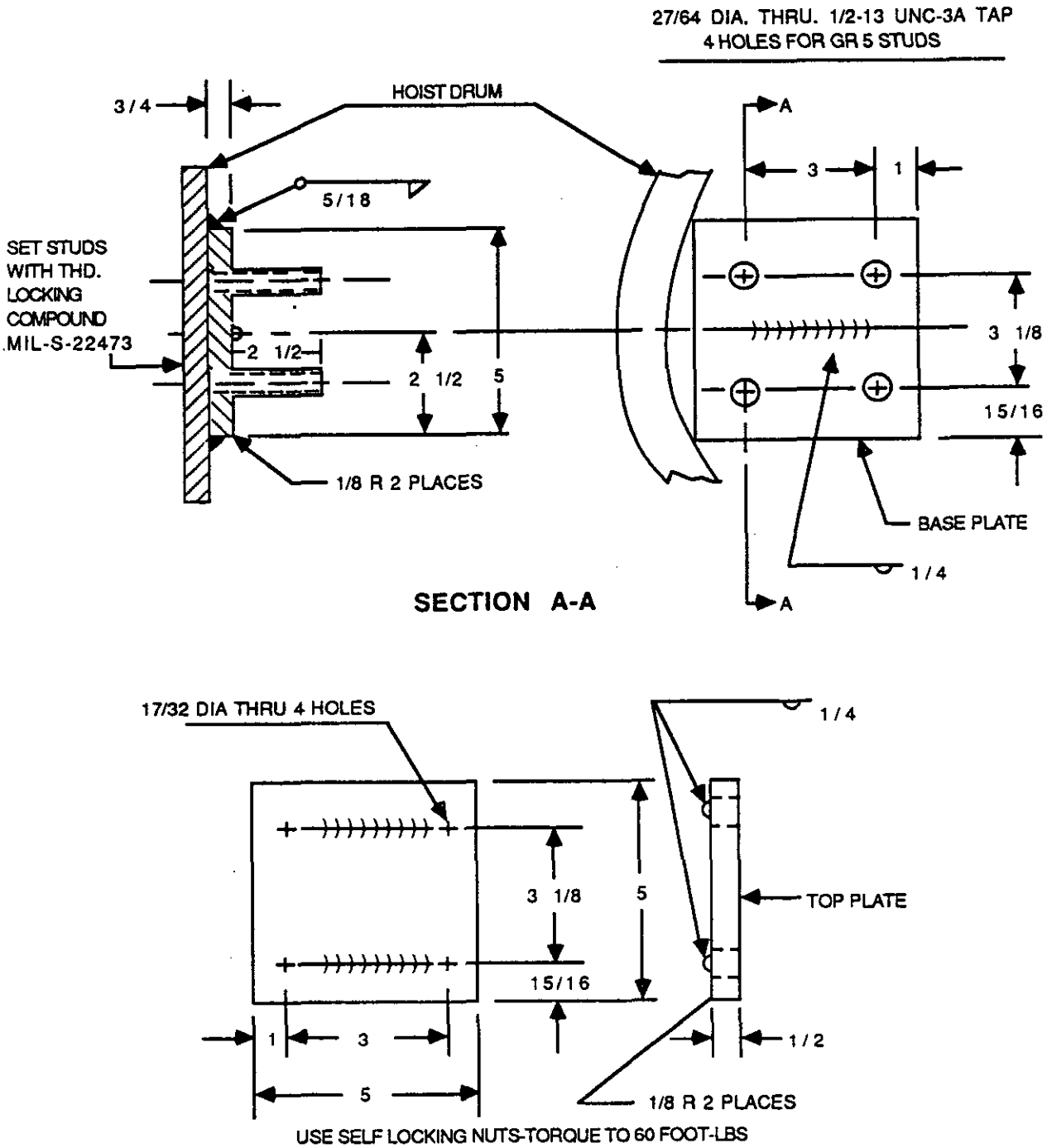


FIGURE 1. Wire rope clamp for hoist drum.

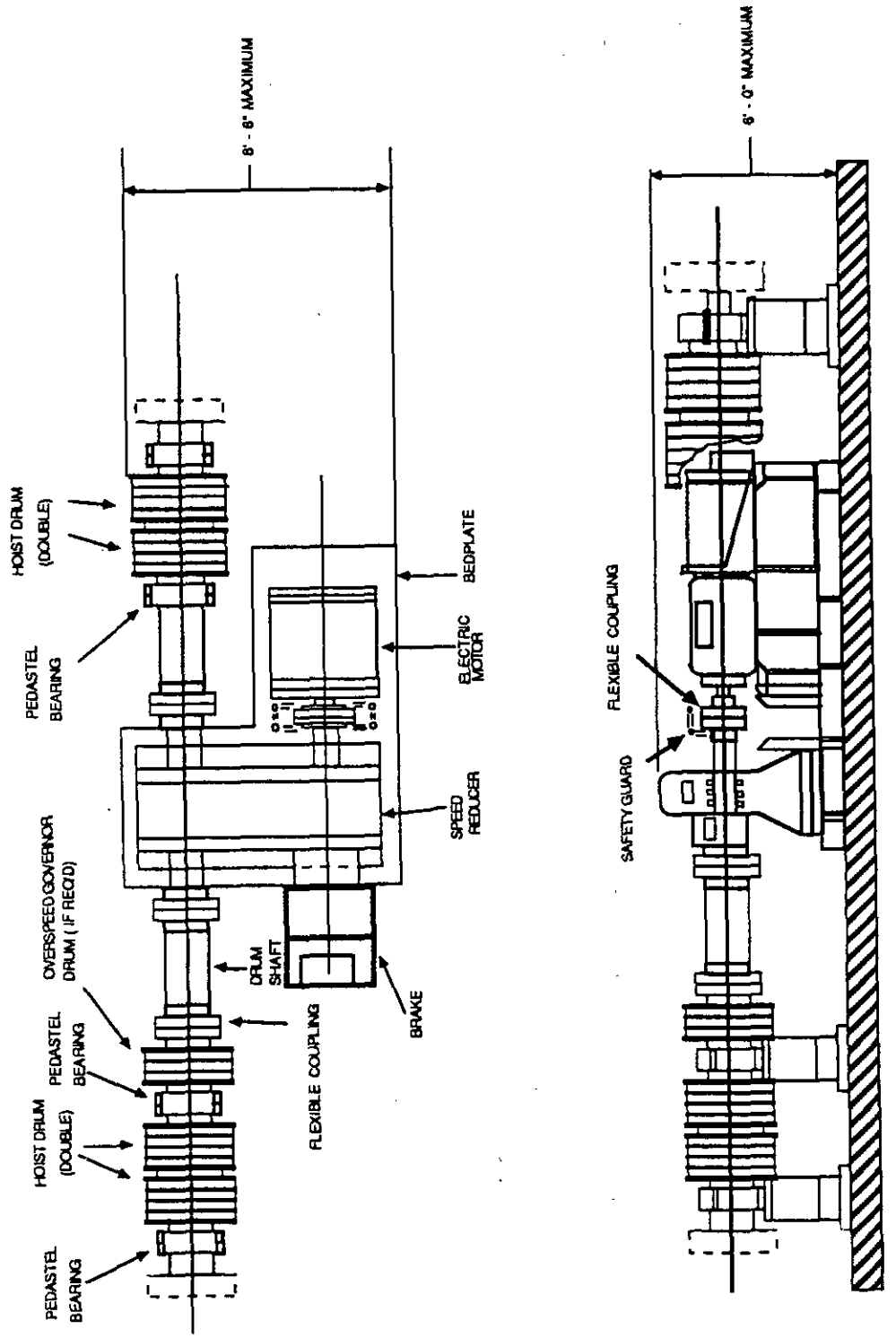


FIGURE 2. Elevator hoist machinery arrangement (double drums).

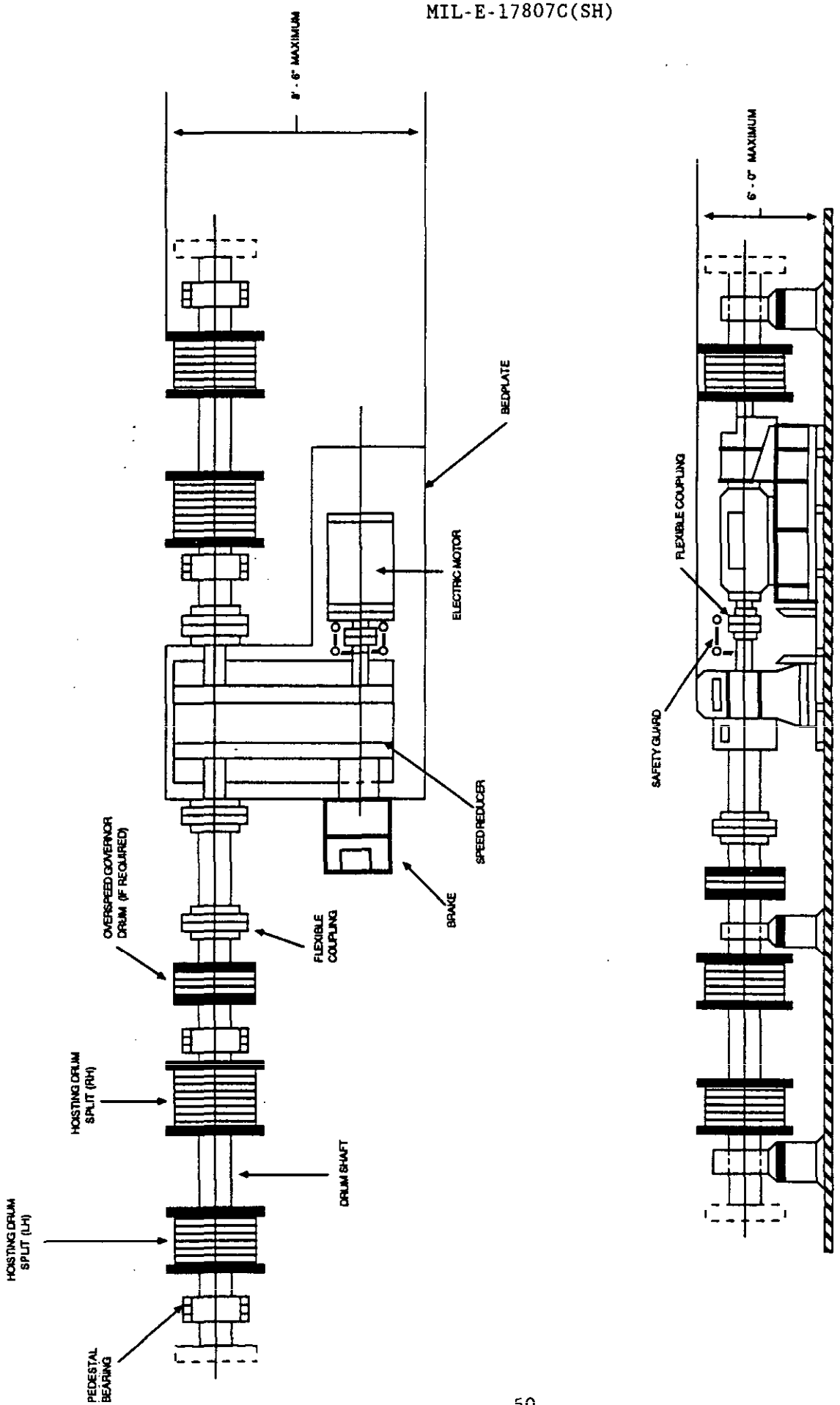
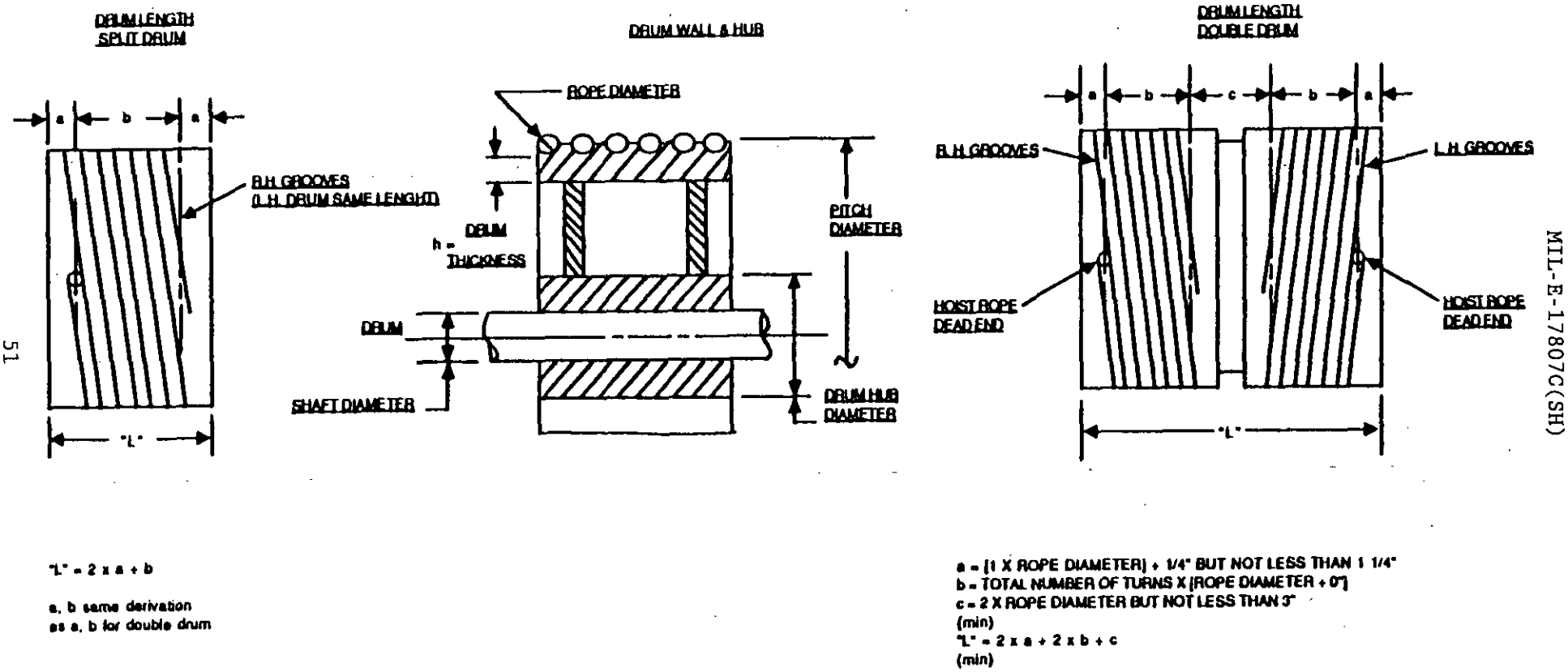


FIGURE 2. Elevator hoist - rope arrangement (split drums).



"L" = 2 x a + b

a, b same derivation as a, b for double drum

a = (1 X ROPE DIAMETER) + 1/4" BUT NOT LESS THAN 1 1/4"
b = TOTAL NUMBER OF TURNS X (ROPE DIAMETER + 0")
c = 2 X ROPE DIAMETER BUT NOT LESS THAN 3"
(min)
"L" = 2 x a + 2 x b + c
(min)

FIGURE 4. Hoist drum dimensions.

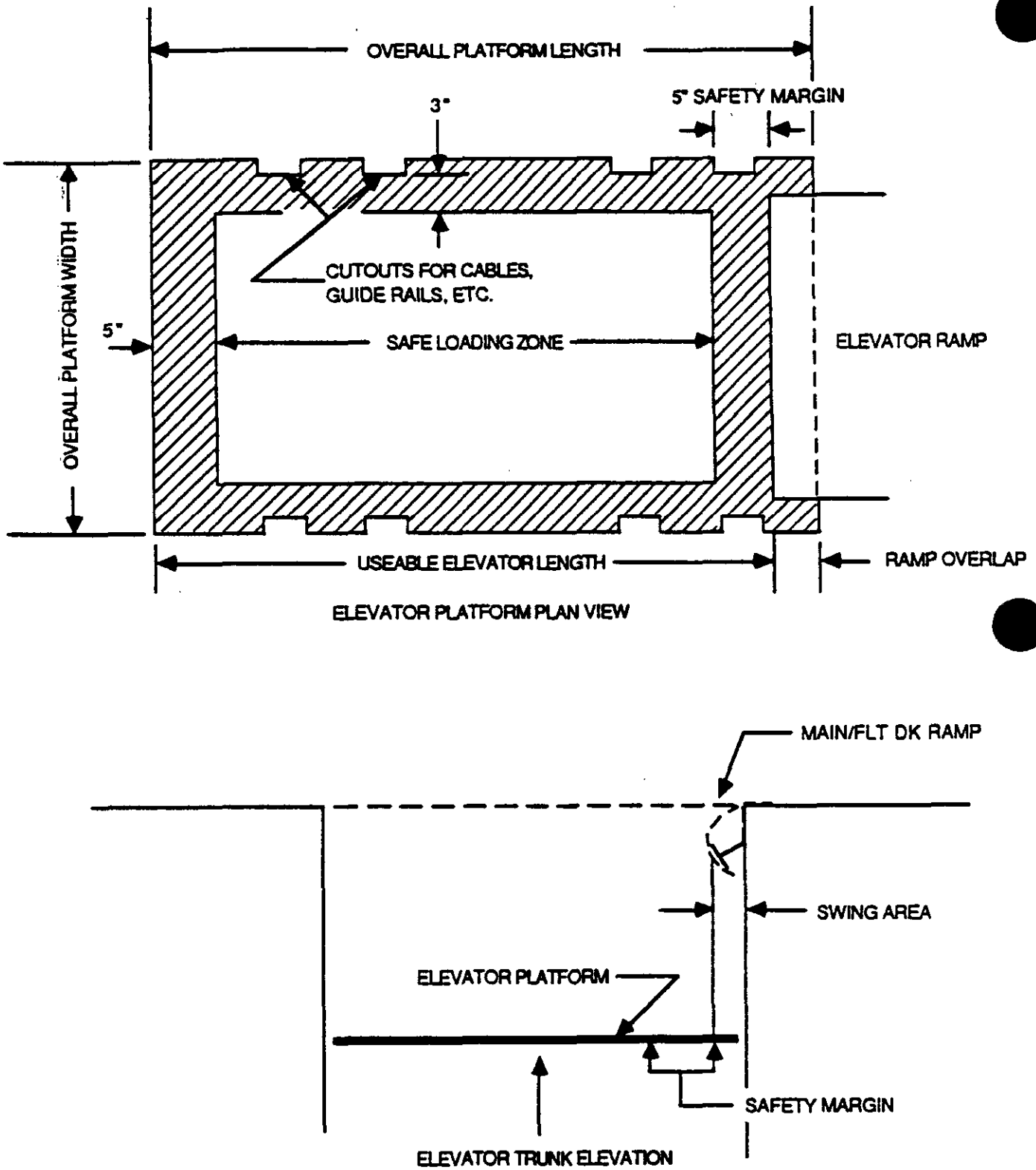


FIGURE 5. Weapons-elevator safety margin.

APPENDIX A

ENGINEERING DRAWINGS TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix covers information that shall be included on the drawings when specified in the contract or order. This appendix is mandatory only when data item description DI-DRPR-80651 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-M-9868 - Microfilming of Engineering Documents, 35mm Requirements for.
MIL-T-31000 - Technical Data Packages, General Specification for.

STANDARDS

MILITARY

DOD-STD-100 - Engineering Drawing Practices.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

30. DRAWING CONTENTS

30.1 Drawing contents. Drawing shall be in accordance with DOD-STD-100 and MIL-T-31000 and contain the following information technical features.

(a) A list of material listing all components. Each item shall be identified by the catalog number assigned by the original manufacturer of that item.
(b) Assembly and details with front and side view of the control system together with overall dimensions. The center of gravity shall be shown in both views of the enclosure when over 100 pounds.
(c) Connection and schematic diagrams of the control circuit, motor and brake, including connections to any remote devices. Relay contacts shown shall include reference to the drawing zone number where the relay coil is located.

(d) Description of operation of the control system.
(e) Description of adjustments which can be made on the equipment.
(f) A diagram showing the location of the various components in their slots.
(g) The interconnecting wiring behind the circuit board slots for control systems.
(h) A guide for failure analysis to permit the location of the probable failure.
(i) The weight of all assemblies and any subassemblies or components.
(j) A terminal connection table.
(k) Drawings shall be numbered to fit into logical groupings with subassemblies following assemblies, and so forth, starting with the general arrangement.
(l) Drawings should be done on computer aided drafting machines, in a language compatible with the Initial Graphics Exchange Specification (IGES) prepared by the U.S. Bureau of Standards.
(m) Drawings shall provide details of all components sufficient to permit fabrication by any industrial activity. This requirement shall be waived for stock items such as nuts and screws that are nationally stocked items or have three or more suppliers.
(n) Schematic drawings shall describe system operation. Assembly and arrangement drawings shall contain functional description of component, subsystem or system shown.
(o) A table of repair parts and special tools.
(p) A table of labels, warning, caution and instruction plates.
(q) Manufacturing or modification details for enclosures.
(r) A table for the relays.
(s) Specific installation instructions for equipment being supplied. This shall include grounding, shielding, cable routing, acceptable types and sizes of cabling, and so forth.
(t) Where materials of identical or equal characteristics can be identified by more than one specification or standard, the drawings shall reference only one specification or standard, in accordance with the following order of preference.

(1) Industry and technical society specification or standard.
(2) Federal specification.
(3) Military specification.
(4) Manufacturer's specification or standard.

30.2 Microfilming of engineering documents, 35mm and PACM preparation, microfilm aperture card. The contractor shall prepare microfilm, aperture/tabulating cards, and listing in accordance with MIL-M-9868.

APPENDIX B

DESIGN DATA AND CALCULATIONS TECHNICAL CONTENT REQUIREMENTS

10. *SCOPE*

10.1 Scope. This appendix covers information that shall be included in the design data and calculations when specified in the contract or order. This appendix is mandatory only when data item description DI-GDRQ-80650 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. DESIGN DATA AND CALCULATIONS TECHNICAL CONTENTS

30.1 Calculations. Calculations shall be prepared to justify the size of the speed reducer, couplings, bearings, and shafting and to ensure that all components and their foundations are in compliance with the stress limits specified in 3.4.3. Calculations shall consider fatigue, surface conditions, size, temperature, stress concentrations, and the type of stress.

INDEX

INDEX - (Continued)

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INDEX - (Continued)

INDEX - (Continued)

*U.S. GOVERNMENT PRINTING OFFICE: 1991 - 504-034/50179

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. 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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
3. DOCUMENT TITLE		

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact (TPOC): Mr. Ken Brayton (SEA 56W4) PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	b. TELEPHONE (Include Area Code) (1) Commercial TPOC: 703-602-9394	(2) AUTOVON 8-332-9394
c. ADDRESS (Include Zip Code) Commander, Naval Sea Systems Command Department of the Navy (SEA 55Z3) Washington, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	