INCH-POUND
MIL-DTL-17807D(SH)
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SUPERSEDING
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DETAIL SPECIFICATION

ELEVATOR, WINDING DRUM, ELECTROMECHANICAL (SHIPBOARD)

Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla mil.

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

1. SCOPE

1.1 Scope. This specification covers electromechanical shipboard winding drum elevators used to transport weapons, ordnance, cargo, stores, equipment, and other materials. This specification does not apply to aircraft elevators or elevators designed primarily for transport of personnel.

1.2 Classification. Elevator weight class, control method, and hoist motor type corresponds to the classes, methods, and types listed in table I as specified (see 6.2.b).

TABLE I. Elevator classifications.

Description		Classification
Weight classes (see 3.11.1)	Rated load not to exceed 6,000 lbs	Weight class 1
	Rated load not to exceed 12,000 lbs	Weight class 2
	Rated load not to exceed 16,000 lbs	Weight class 3
Logic control methods (see 3.13)	Hybrid relay logic	Hybrid relay logic control
	Solid-state programmable logic	Solid-state programmable logic control
Hoist motor types (see 3.11.3.7 and 3.11.3.8)	Two-speed reversible motor with AC magnetic motor controller	Two-speed
	Variable speed reversible motor with AC variable speed drive	Variable speed

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

FF-S-85 - Screw, Cap, Slotted and Hexagon Head

FF-S-86 - Screw, Cap, Socket-Head

FF-S-92 - Screw, Machine, Slotted, Cross-Recessed or Hexagon Head

FF-S-200 - Setscrews: Hexagon Socket and Spline Socket, Headless

RR-W-410 - Wire Rope and Strand

FEDERAL STANDARDS

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

COMMERCIAL ITEM DESCRIPTIONS

A-A-52401	-	Bearing, Sleeve (Steel-Backed)
A-A-52414	-	Bearing, Roller, Thrust
A-A-55598	-	Bearings, Roller, Cylindrical, Single Row of Rollers, Two Roller Retaining Ribs on Inner Ring, One Roller Retaining Rib on Outer Ring, One Direction Locating
A-A-55599	-	Bearings, Roller, Cylindrical, Single Row of Rollers, One Roller Retaining Ribs on Inner Ring, Two Roller Retaining Ribs on Outer Ring, One Direction Locating
A-A-55601	-	Bearings, Roller, Cylindrical, Single Row of Rollers, Cylindrical Inner Ring, Two Roller Retaining Ribs on Outer Ring, Non-Locating
A-A-55602	-	Bearings, Roller, Cylindrical, Single Row of Rollers, Two Roller Retaining Ribs on Inner Ring, Cylindrical Outer Ring, Non-Locating
A-A-59125/1	-	Terminal Boards, Molded, Barrier Screw Type, Class 37TB
A-A-59125/3	-	Terminal Boards, Molded, Barrier Screw Type, Class 39TB
A-A-59125/16	-	Terminal Boards, Molded, Barrier Stud Type, Class 10TB
A-A-59125/20	-	Terminal Boards, Molded, Barrier Stud Type, Class 16TB
A-A-59125/21	-	Terminal Boards, Molded, Barrier Stud Type, Class 17TB
A-A-59125/24	-	Terminal Boards, Molded, Barrier Stud Type, Class 26TB

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-901	-	Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
MIL-DTL-917	-	Electric Power Equipment, Basic Requirements
MIL-DTL-1222	-	Studs, Bolts, Screws and Nuts for Applications Where a High Degree of Reliability is Required; General Specification for
MIL-DTL-2212	-	Contactors and Controllers, Electric Motor AC or DC, and Associated Switching Devices
MIL-PRF-2765	-	Rubber Sheet, Strip, Extruded, and Molded Shapes, Synthetic, Oil Resistant
MIL-DTL-6807	-	Switches, Rotary, Selector Power, General Specification for
MIL-DTL-15024	-	Plates, Tags and Bands for Identification of Equipment, General Specification for
MIL-P-15024/5	-	Plate, Identification
MIL-PRF-15160	-	Fuses, Instrument, Power, and Telephone, General Specification for
MIL-T-16315	-	Transformers, Power, Step-Down (Miscellaneous, Naval Shipboard Use)

MIL-DTL-16377	-	Fixtures, Lighting; and Associated Parts; Shipboard Use, General Specification for
MIL-DTL-16392	-	Brake, Electro-Mechanical, Naval Shipboard
MIL-DTL-17060	-	Motors, Alternating Current, Integral-Horsepower, Shipboard Use
MIL-DTL-17361	-	Circuit Breaker Types AQB/NQB, Air, Electric, Low Voltage, Insulated Housing (Shipboard Use), General Specification for
MIL-DTL-18396	-	Switches, Meter and Control, Naval Shipboard
MIL-R-19523	-	Relays, Control
MIL-S-22698	-	Steel Plate, Shapes and Bars, Weldable Ordinary Strength and Higher Strength: Structural
MIL-PRF-23236	-	Coating Systems for Ship Structures
MIL-S-24093	-	Steel Forgings, Carbon and Alloy Heat Treated
MIL-S-24235	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, General Specification for
MIL-PRF-24385	-	Fire Extinguishing Agent, Aqueous Film-Forming Foam (AFFF) Liquid Concentrate, for Fresh and Sea Water
MIL-DTL-24441	-	Paint Epoxy-Polyamide General Specification for
DOD-G-24508	-	Grease, High Performance, Multi-Purpose (Metric)
MIL-DTL-24643	-	Cables, Electric, Low Smoke Halogen-Free, for Shipboard Use, General Specification for
MIL-PRF-24667	-	Coating System, Non-Skid for Roll, Spray, or Self-Adhering Application
MIL-C-24707	-	Castings, Ferrous, General Specification for
MIL-DTL-24707/1	-	Castings, Ferrous, for Machinery and Structural Applications
MIL-C-24707/5	-	Castings, Ductile Iron and Austenitic Ductile Iron
MIL-PRF-24711	-	Switch, Proximity, Solid-State
MIL-PRF-28750	-	Relays, Solid-State, General Specification for
MIL-PRF-32168	-	Variable Speed Drive System for Induction and Synchronous Machines
MIL-DTL-32613	-	Controller, Auxiliary-System, Naval Shipboard Use
MIL-B-81793	-	Bearings, Ball, Annular, for Instruments and Precision Rotating Components
MIL-DTL-83420	-	Wire Rope, Flexible, for Aircraft Control, General Specification for

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-108	-	Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment
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-461	-	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-681	-	Identification Coding and Application of Hookup and Lead Wire
MIL-STD-740-2	-	Structureborne Vibratory Acceleration Measurements and Acceptance Criteria of Shipboard Equipment
MIL-STD-882	-	System Safety
MIL-STD-889	-	Dissimilar Metals
MIL-STD-1310	-	Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse (EMP) Mitigation, and Safety
MIL-STD-1399-300-1	-	Low Voltage Electric Power, Alternating Current
MIL-STD-1472	-	Human Engineering
MIL-STD-1474	-	Noise Limits
MIL-STD-2003	-	Electric Plant Installation, Standard Methods for Surface Ships and Submarines

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-267	-	Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment
MIL-HDBK-470	-	Designing and Developing Maintainable Products and Systems, Volume I and Volume II
MIL-HDBK-781	-	Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification, and Production

(Copies of these documents are available online at https://quicksearch.dla mil.)

2.2.2 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 of these documents are those cited in the solicitation or contract.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.66	-	Occupational Safety and Health Standards, Personal Fall Arrest System (Section I)

(Copies of this document are available online at http://www.ecfr.gov/.)

DEPARTMENT OF DEFENSE ISSUANCES

DoDI 8551.01	-	Ports, Protocols, and Services Management (PPSM)

(Copies of this document are available online at www.dtic mil/whs/directives/.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) DRAWINGS

573-6723830	-	Elevator Hybrid Relay Controller – Dual Hatch
573-6723831	-	Elevator Hybrid Relay Controller – Single Hatch
701-6737468	-	Hydro Load Test Device for Weapon/Cargo Elev Instl and Details
803-1916300	-	Aircraft Securing and Engine Run-Up Fittings

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

803-6397322 - Weapons/Cargo Elevator Platform Safety Linkage and Guide Roller System

803-6397409 - Weapons/Cargo Elevator Straight End Guide Rail Section

803-6397410 - Weapons/Cargo Elevator Tapered End Guide Rail Section

803-6397411 - Weapons/Cargo Elevator Tapered End Guide Rail Section

803-6397412 - Weapons/Cargo Elevator Guide Rail Alignment

803-6397413 - Weapons/Cargo Elevator Swaged Wire Rope End Fittings

803-6397414 - Weapons/Cargo Elevator Wire Rope Assemblies

803-6397416 - Weapons/Cargo Elevator Slack Rope Safety Device Assembly and Details

803-6397421 - Cargo/Weapons Elevator Overspeed Governor Assembly and Details

803-6397422 - Weapons/Cargo Elevator Overspeed Governor Deflection Sheave Assembly

803-6397423 - Weapons/Cargo Elevator Sheave Assembly Cantilever Mount Type

803-6397424 - Weapons/Cargo Elevator Sheave Assembly Straddle Mount Type

803-8436628 - Elevator Hybrid Relay Controller – No Hatch

804-5184155 - Liferails, Lifelines and Awning Stanchions (AL & STL) Details and L/M

804-5184187 - Tiedown Assembly (Hi-Shock) for Pallets, Cradles, Containers

804-5184191 - Tiedown Assembly for Ready Service Skids

(Copies of these documents are available from the applicable repositories listed in S0005-AE-PRO-010/EDM, which can be obtained online via Technical Data Management Information System (TDMIS) at https://mercury.tdmis.navy.mil/. Copies of these documents may also be obtained from the Naval Ships Engineering Drawing Repository (NSEDR) online at https://199.208.213.105/webjedmics/index.jsp. To request an NSEDR account for drawing access, send an email to NNSY_JEDMICS_NSEDR_HELP_DESK@navy mil.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

0900-LP-008-2010 - The Design and Care of Wire Rope Installations

S9074-AQ-GIB-010/248 - Requirements for Welding and Brazing Procedure and Performance Qualification

S9074-AR-GIB-010/278 - Requirements for Fabrication Welding and Inspection, Casting Inspection and Repair for Machinery, Piping and Pressure Vessels

T9070-AL-DPC-020/077-2 - NAVSEA Hazardous Material Avoidance Process

T9070-BM-DPC-010/613-1 - Wire Rope Systems Design

T9074-BD-GIB-010/0300 - Base Materials for Critical Applications: Requirements for Low Alloy Steel Plate, Forgings, Castings, Shapes, Bars, and Heads of HY-80/100/130 and HSLA-80/100

(Copies of these documents are available online via Technical Data Management Information System (TDMIS) at https://mercury.tdmis.navy.mil/ by searching for the document number without the suffix. Refer questions, inquiries, or problems to: DSN 296-0669, Commercial (805) 228-0669. These documents are available for ordering (hard copy) via the Naval Logistics Library (NLL) at https://nll.navsup.navy mil. For questions regarding the NLL, contact the NLL Customer Service at nllhelpdesk@navy.mil, (866) 817-3130, or (215) 697-2626/DSN 442-2626.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) STANDARD ITEMS

Standard Item 009-32 - Cleaning and Painting Requirements; Accomplish

(Copies of this document are available online at http://www.navsea.navy.mil/Home/RMC/CNRMC/OurPrograms/SSRAC/NSI.aspx.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AEROSPACE INDUSTRIES ASSOCIATION (AIA)

NASM25027 - Nut, Self-Locking, 250 °F, 450 °F, and 800 °F

(Copies of this document are available online at www.aia-aerospace.org.)

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 19.1 - Tapered Roller Bearings – Radial – Metric Design

ABMA 19.2 - Tapered Roller Bearings – Radial – Inch Design

ABMA 20 - Radial Bearings of Ball, Cylindrical Roller, and Spherical Roller Types – Metric Design

ABMA 24.1 - Thrust Bearings of Ball, Cylindrical Roller, and Spherical Roller Types – Metric Design

ABMA 24.2 - Thrust Bearings of Ball and Cylindrical Roller Types – Inch Design

(Copies of these documents are available online at www.americanbearings.org.)

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 915-1 - Inspection Practices - Part 1: Cylindrical Gears - Tangential Measurements

AGMA 915-2 - Inspection Practices - Part 2: Cylindrical Gears - Radial Measurements

AGMA 922 - Load Classification and Service Factors for Flexible Couplings

AGMA ISO 1328-1 - Cylindrical Gears - ISO System of Flank Tolerance Classification - Part 1: Definitions and Allowable Values of Deviations Relevant to Flanks of Gear Teeth

ANSI/AGMA 2015-2 - Gear Tooth Flank Tolerance Classification System – Definitions and Allowable Values of Double Flank Radial Composite Deviations

ANSI/AGMA 6001 - Design and Selection of Components for Enclosed Gear Drives

ANSI/AGMA 6013 - Standard for Industrial Enclosed Gear Drives

(Copies of these documents are available online at www.agma.org.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ANSI/ASSP Z359.1 - Safety Requirements for Personal Fall Arrest Systems, Subsystems & Components

(Copies of this document are available online at www.assp.org.)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A17.1/CSA B44 - Safety Code for Elevators and Escalators

ASME B17.1 - Keys and Keyseats

ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay)

(Copies of these documents are available online at www.asme.org.)

ASTM INTERNATIONAL

ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service

ASTM A757/A757M - Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing and Other Applications, for Low Temperature Service

ASTM B438 - Standard Specification for Bronze-Base Powder Metallurgy (PM) Bearings (Oil-Impregnated)

ASTM B439 - Standard Specification for Iron-Base Powder Metallurgy (PM) Bearings (Oil-Impregnated)

ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

ASTM D5363 - Standard Specification for Anaerobic Single-Component Adhesives (AN)

(Copies of these documents are available online at www.astm.org.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 10012 - Measurement Management Systems – Requirements for Measurement Processes and Measuring Equipment

(Copies of this document are available online at www.iso.org.)

LASER INSTITUTE OF AMERICA (LIA)

ANSI Z136.1 - Safe Use of Lasers

(Copies of this document are available online at http://www.lia.org.)

SAE INTERNATIONAL

SAE AMS-QQ-S-763	-	Steel, Corrosion Resistant, Bars, Wire, Shapes, and Forgings
SAE AS8943	-	Bearings, Sleeve, Plain and Flanged, Self-Lubricating -65 to +250 °F
SAE AS15004	-	Fitting, Lubrication, Hydraulic, Surface Check, .250-28 Taper Threads, Nickel-Copper Alloy, Type IV
SAE AS15005	-	Fitting, Lubrication, Hydraulic, Throat or Surface Check, 1/8 Pipe Threads, Nickel-Copper Alloy, Type V
SAE AS35411	-	Fittings, Lubrication
SAE AS39901	-	Bearings, Roller, Needle, Airframe, Antifriction, Inch
SAE AS50151	-	Connectors, Electrical, Circular Threaded, AN Type, General Specification for
SAE AS81820	-	Bearings, Plain, Self-Aligning, Self-Lubricating, Low Speed Oscillation
SAE AS81934	-	Bearings, Sleeve, Plain and Flanged, Self-Lubricating
SAE AS81935	-	Bearings, Plain, Rod End, Self-Aligning, Self-Lubricating, General Specification for (-65 to +325 °F)
SAE J2360	-	Automotive Gear Lubricants for Commercial and Military Use

(Copies of these documents are available online at www.sae.org.)

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC-SP 10	-	Near-White Blast Cleaning, Surface Preparation Specification No. 10

(Copies of this document are available online at www.sspc.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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.d), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.2.

3.2 Material and components. 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 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 6061-T6 and 70XX-T6 shall not be used.

3.2.3 Steel plate. High yield strength steel plate shall be in accordance with T9074-BD-GIB-010/0300. All other steel plate shall be in accordance with MIL-S-22698.

3.2.4 Cast steel. Cast steel to be welded shall be in accordance with MIL-C-24707 and MIL-DTL-24707/1 (grade WCA of ASTM A216/A216M or grade A1Q of ASTM A757/A757M).

3.2.5 Forged steel. Forged steel to be welded shall be in accordance with 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.

3.2.8 Fabrication, welding, brazing, and inspection. Fabrication, welding, and inspection shall be in accordance with S9074-AR-GIB-010/278. Where practicable, welded steel construction shall be used in lieu of castings. Where welding and brazing procedures are to be implemented, they shall comply with the requirements of S9074-AQ-GIB-010/248. 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 in accordance with S9074-AR-GIB-010/278.

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.

3.2.11 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.2.12 Dissimilar metals. Coupled dissimilar metals shall be protected against corrosion in a marine environment in accordance with MIL-STD-889.

3.2.13 Lubricants and hydraulic fluids. Lubricants and hydraulic fluids used in the elevator system shall meet the physical, functional, environmental, and service life requirements of the application. Lubricants and hydraulic fluids shall be selected using MIL-HDBK-267 as guidance.

3.2.14 Prohibited materials. The elevator system shall not contain any chemicals categorized as “prohibited” in accordance with T9070-AL-DPC-020/077-2.

3.3 Design.

3.3.1 Design philosophy. The design philosophy for the electromechanical elevators is to achieve the performance, safety, maintainability, and reliability specified herein. Special design emphasis shall be placed on minimizing system weight, volumetric footprint, manning requirements, and maintenance requirements.

3.3.2 Storm sea conditions. The elevator system shall withstand dynamic forces produced by motion of the ship in a seaway. Elevators shall hold the platform with rated load (see 6.7.15) and maintain a static position under storm sea conditions and loading factors as specified (see 6.2.f). When subjected to the storm sea conditions specified with all trunk closures fully closed, elevator equipment shall neither come adrift nor become a hazard to personnel or other equipment. All elevator machinery shall maintain satisfactory lubrication with no loss of lubricant under the storm sea conditions specified.

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

3.3.4 Temperature. Equipment installed in locations exposed to the weather shall operate satisfactorily throughout an ambient temperature range of -10 to 150 °F. Equipment not exposed to the weather shall operate satisfactorily throughout an ambient temperature range of 32 to 120 °F. All equipment shall operate in an atmosphere of relative humidity between 5 and 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 consists of 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 Manning. Dispatch operation of the elevator shall require not more than three control stations manned simultaneously. Manning of elevator machinery rooms shall not be required, except to prepare for or secure from elevator operations, or to perform maintenance or fault correction. Elevators shall not require operators to ride the platform. Riding of the elevator platform by personnel shall be restricted by administrative controls to the following special cases:

a. Elevators specified to have Emergency Medical Evacuation (MEDEVAC) features (see 3.5.3.8 and 6.7.4) may be used to transport injured personnel and attending medical personnel when the specified Emergency MEDEVAC features are utilized and such operations are authorized by the command having jurisdiction.

b. Qualified maintenance personnel may ride the platform to perform inspection, test, maintenance, and repair procedures when authorized by the command having jurisdiction.

3.3.7 Fail-safe operation. Elevator equipment shall be constructed for fail-safe operation (see 6.7.5). Failure of the power source or manual or power-operated drive mechanism shall not result in damage to the load or jeopardize the safety of personnel or result in uncontrolled movement of the equipment and load. In the event of power failure, all power-operated elevator equipment shall come to a controlled stop without damage. Restoration of power shall not result in automatic resumption of any equipment operation that may jeopardize the safety of the load, equipment, or personnel. Fail-safe shall not be applied to static components, structural members, or other static parts of mechanisms.

3.3.8 Lubrication fittings. Lubrication fittings in accordance with SAE AS35411, SAE AS15004, or SAE AS15005 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 aboard the ship, equipment and machinery shall maintain satisfactory lubrication with no loss of lubricant under the storm sea conditions as specified (see 6.2.f).

3.3.9 Keyways. Where used, straight-cut keyways in couplings and gear shafts shall be close-ended to prevent loss of keys. Two keys, 90 degrees apart, shall be used at all couplings except those for the electric motor-gear reducer. Keyways shall be in accordance with ASME B17.1, class 1 fit or better.

3.3.10 Bearings and bushings. Bearings and bushings shall meet the physical, functional, environmental, and service life requirements of the application. Self-lubricating bearings and bushings shall be used wherever practical. The use of small bearings and bushings that require lubrication shall be minimized. Rotating anti-friction bearings shall be sealed and shall be selected to result in an L-10 life of not less than 10,000 hours. Design shall permit the replacement of bearings without use of special tools (see 6.7.16). 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. Bearings may conform to one or more of the following specifications:

A-A-55598	ABMA 19.1	MIL-B-81793
A-A-55599	ABMA 19.2	SAE AS39901
A-A-55601	ABMA 20	SAE AS81934
A-A-55602	ABMA 24.1 or ABMA 24.2	SAE AS81935
A-A-52401	ASTM B438	SAE AS81820
A-A-52414	ASTM B439	SAE AS8943

3.3.11 Screw threads. Screw threads shall be in accordance with FED-STD-H28. Class 5 fit shall be used for the setting end of studs and for special fitted work where thread interference is required and disassembly is unlikely. Bolts and studs for holding down equipment to their foundations or sub-bases shall be installed in holes no greater than the sizes indicated in table II:

TABLE II. Bolt/stud clearance hole tolerances.

Normal bolt diameter (inches)	Maximum diameter of hole (inches)
¾ and smaller	Nominal bolt diameter +1/32
Larger than ¾	Nominal bolt diameter +1/16

Table II 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, MIL-DTL-1222, and NASM25027.

3.3.13 Thread protrusion. For a threaded fastener, not less than one thread, but not more than four threads, shall protrude beyond the crown of the nut, except where additional thread protrusion is required for adjustments. 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 such that the shear load strength of the engaged threads is greater 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 one 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, 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 the 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 a beveled end. Bottom-tapped holes shall have full threads for the entire depth.

3.3.17 Foundation bolts. Foundation bolts or studs shall comply with MIL-DTL-1222, grade 5, and shall be not less than 0.5 inch in diameter.

3.3.18 Through-bolting. Through-bolting shall be used where 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 the use of such bolting is not possible, studs, tap bolts, socket heads, 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 in accordance with MIL-DTL-1222. Self-locking nuts, in accordance with NASM25027, shall be used to hold down machinery and equipment to sub-bases and foundations.

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. Shear shall be through the body of the bolt, not through the threaded portion. Assembly of coupled machinery components and their associated bedplates and foundations shall utilize fitted bolts, dowelling, or similar methods as required to meet the performance, reliability, and life requirements specified herein, and to re-establish alignment after disassembly. Where fitted bolts are used, fit shall be as specified in table III, and the mating surfaces of the bolt and bolt hole shall have a surface no smoother than a 63-micro-inch roughness height rating (RHR) in accordance with ASME B46.1.

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

Nominal size (inches)	Maximum clearance (+) and interference (-) (inches)
0.5 to 1.125	+0.0005 -0.0010
1.25 to 1.875	+0.0006 -0.0013
2.0 to 3.0	+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 B633. 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 in accordance with SAE AMS-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, swag, 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 that adjoin aluminum or aluminum alloys.

3.3.22 Sintered metal fasteners. Sintered metal fasteners shall not be used.

3.3.23 Thread-locking compound. Where a thread-sealing or thread-locking compound is used, the material and its application shall be in accordance with ASTM D5363. Thread-locking compound, in accordance with ASTM D5363, grade CV (blue), shall be used for the settings of studs.

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. The elevator system shall meet the requirements of MIL-DTL-901 for the shock grade, as specified (see 6.2 h). Shock requirements apply with the unloaded elevator platform positioned at the stow level (see 6.7.17), as specified (see 6.2.oo), and the elevator control system energized. Elevator trunk closure systems shall meet the requirements of the shock grade, as specified (see 6.2 h), in the fully closed configuration. Portable elevator equipment shall meet the requirements of the shock grade, as specified (see 6.2.h), in the stowed condition.

3.3.26 Vibration. 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 equipment. When specified (see 6.2.i), explosion-proof equipment is required if located in a space in which hypergolic fueled weapons, Fuel Air Explosive (FAE) weapons, or an explosive atmosphere may be present. Unless otherwise specified (see 6.2.i), equipment contained entirely within the elevator trunk is not required to be explosion-proof.

3.3.28 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.

3.3.29 Noise. When specified (see 6.2.j), the elevator system shall comply with the airborne noise acceptability criteria of MIL-STD-1474 for category D equipment.

3.3.30 Components exposed to harsh environment. All equipment installed in elevator trunks, hangar bays, well decks, or exposed to weather shall function as specified herein after exposure to, and in the presence of, the following: lubricants, hydraulic fluids, solvents, JP-4 and JP-5 aviation fuels, aqueous film-forming foam (AFFF) fire extinguishing agent (MIL-PRF-24385), seawater, and salt fog with no sign of corrosion or other deterioration that could affect performance or predicted design life.

3.3.31 Particulates. All elevator system components installed in elevator trunks, hangar bays, well decks, or exposed to weather shall resist damage or degradation of performance due to exposure to wind-blown sand, dust, and other abrasives. Where the threat of exposure exists, provisions shall be made for flushing all rotating and pivoting points.

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

3.3.33 Levels served. The elevator shall be constructed for stopping, loading and unloading, and operation from each deck level specified (see 6.2 k). Handling equipment used for loading and unloading the elevator platform (see 6.2.m) at each level and the direction of loading shall be as specified (see 6.2.l).

3.3.34 Trunk. The elevator hoistway shall be fully enclosed in a rigid trunk throughout the range of platform travel. Unless otherwise specified (see 6.2 n), the trunk shall have no openings except those required for ventilation and elevator operation and maintenance. The trunk shall be designed to prevent personnel or material handling equipment from entering, falling into, or reaching into the trunk enclosure. The trunk shall meet the strength, tightness, ballistic, and hydrostatic head pressure requirements as specified (see 6.2.n).

3.3.34.1 Pit. The trunk shall include a pit extending below the lowest level served by the elevator. The pit shall have sufficient depth to allow platform travel to the lowest level while complying with the platform clearance requirements above the buffer springs (see 3.5.3.3). Elevators serving weather decks, having flush deck hatches, or having trunk fire suppression systems shall be provided with a means of de-watering the pit.

3.3.34.2 Platform to deck gaps. At loading levels, horizontal gaps between the platform working deck and the adjacent deck, trunk bulkhead, or trunk doors at loading levels shall not exceed 6 inches. Gratings, deck extensions, and guards may be used to meet this requirement to prevent personnel from stepping or falling through the horizontal gap. Gratings, deck extensions, or guards are not required at locations where platform-mounted liferails will prevent personnel from stepping or falling through a horizontal gap (see 3.5.3.7).

3.3.35 Trunk closures. Unless otherwise specified (see 6.2.o), trunk closures and trunk closure operating systems shall be considered part of the elevator system and shall meet the requirements specified herein. Elevator trunk doors and hatches shall be provided at the locations specified (see 6.2.o). The type, size, and method of operation of trunk closures shall be as specified (see 6.2.o). Hatches and their operating equipment shall provide a sufficient, clear, unobstructed opening to allow passage of the loaded elevator platform when the hatch is fully open. Trunk closures and their operating equipment shall not interfere with platform loading and unloading operations when the closure is fully open. Trunk doors shall be designed so that it is not possible to position any trunk door in the way of platform travel. Flush deck hatches and hinged doors shall not be hinged to swing into the trunk. Doors and hatches shall be provided with hinges, guides, or other means with which to prevent them from traveling beyond, or coming adrift from, their intended range of motion. Trunk closures in the fully closed condition shall prevent personnel or material handling equipment from entering, reaching into, or falling into the trunk. Door openings shall be provided with a safety chain, staples, and snap hooks as detailed on 804-5184155 to prevent personnel from falling into the trunk during maintenance procedures. The definitions of fully open and fully closed doors and hatches are detailed in 6.7.3 and 6.7.6, respectively.

3.3.35.1 Trunk closure damage control requirements. Trunk closures shall meet the strength, tightness, ballistic, overpressure, and hydrostatic head pressure requirements as specified (see 6.2.p). Flush deck hatches shall maintain the specified tightness and shall not become damaged or permanently deformed when repeatedly subjected to the wheel loads, as specified (see 6.2.q), in the fully closed condition.

3.3.35.2 Door operation. Trunk doors, their associated dogging mechanisms, and securing devices shall be either power operated or manually operated as specified (see 6.2 r). All doors shall be fully operable in moderate sea state conditions (see 3.3.3). Powered doors shall be power operated in each direction of operation. Powered doors shall not slam at their ends of travel. Powered doors shall not rack, jam, or bind when operated. Powered doors shall stop within 6 inches of travel in both the open and closed direction when power is removed, interrupted, any emergency stop (E-STOP) pushbutton (see 3.13.3.1.15) is depressed, or the manual input to the applicable door control is discontinued. Any power operated door, when stopped, shall drift not more than 1 inch per hour under their own weight with moderate sea factors applied. Hinged doors and doors that open by sliding or rolling upward shall be provided with hold-open latches that automatically secure the door in the fully open position. Hold-open latches for powered doors shall automatically release the door when the door is powered closed. Door hold-open latches shall be capable of holding the associated door in the open position under storm sea conditions. Unless otherwise specified (see 6.2.s), the cycle times for powered door equipment shall be in accordance with table IV. See 3.13.3.3 for door controls and 3.13.3.1.12 for door interlocks. See 3.16 for trunk powered closure systems.

TABLE IV. Powered door cycle times.

Door component	Cycle	Minimum cycle time (seconds)	Maximum cycle time (seconds)
Powered dogs	Dog or un-dog	1	3
Powered door	Open or close	8	12
Powered ramp	Deploy or stow	1	5
Powered latches or securing devices	Secure or release	1	3

3.3.35.3 Hatch operation. Unless otherwise specified (see 6.2.t), flush deck hatches, in-trunk hatches (see 6.7.8) and associated dogging mechanisms, securing devices, and hinged guide rails shall be power operated. All hatches shall be fully operable in moderate sea state conditions (see 3.3.3). Powered hatches, dogging mechanisms, and securing devices shall be powered in both directions of operation. Gravity shall not be used as the primary means of opening, closing, or holding hatches. Powered elevator hatches shall stop within 6 inches of travel in both the open and closed direction when power is removed or interrupted, or any E-STOP pushbutton (see 3.13.3.1.15) is depressed. All power operated hatches, when stopped, shall drift not more than 1 inch per hour under their own weight with moderate sea factors applied. Powered hatches shall not be permitted to slam to their ends of travel. Powered hatches shall not rack, jam, or bind when operated. Latching devices shall be provided to automatically secure hatches in the fully open position. Hatch latches shall be capable of holding the associated hatch in the fully open position under storm sea conditions. Unless otherwise specified (see 6.2.u), the cycle times for powered hatch equipment and duty cycle shall be in accordance with table V. See 3.13.3 for hatch controls and interlocks. See 3.16 for trunk powered closure systems.

TABLE V. Powered hatch cycle times.

Hatch component	Cycle	Minimum cycle time (seconds)	Maximum cycle time (seconds)
Hinged guide rails for in-trunk hatch	Deploy or stow	1	5
Dogs	Dog or un-dog	1	3
Hatch	Open or close	18	22
Powered ramp	Deploy or stow	1	4
Latches or securing devices	Secure or release	1	3

3.3.35.4 Ramps. Ramps shall be provided at load levels as required to enable safe access to the platform by personnel and safe loading and unloading of the elevator platform using the specified handling equipment, as specified (see 6.2 m). Ramp incline angles relative to the elevator platform and adjacent deck shall be minimized and shall not exceed 1 inch of rise per linear foot when the ramp is in the loading/unloading position. Working surfaces of ramps shall be provided with a slip-resistant surface. Ramps shall allow for platform normal positioning tolerances of ±0.25 inch and ±0.50 inch of platform vertical movement during loading and unloading operations due to hoist rope stretch. Hinged ramps that swing into the trunk shall be either power operated or mechanically operated by the motion of the elevator platform or associated door. Unless otherwise specified (see 6.2.v), ramp cycle times for powered ramps shall be in accordance with table IV and table V. Powered ramps shall not slam, rack, or jam when operated. Powered ramps shall stop and maintain a static position within 6 inches of travel in both the open and closed direction when power is removed or interrupted, or when any E-STOP pushbutton (see 3.13.3.1.15) is depressed. Manually operated hinged ramps and portable ramps shall not be used to bridge gaps between the elevator platform and the load level. Where manually operated hinged ramps are used, a mechanical means of holding the ramp in the stowed position under storm sea conditions (see 3.3.2) shall be provided.

3.3.35.5 Trunk closure emergency operation. Powered trunk closures, their associated dogging mechanisms, ramps, and securing devices shall be manually operable in the event that the primary power source is not available. The manual operating means shall maintain positive control of the connected load and shall not present a back drive hazard to the operator. The manual operating means for trunk doors, their associated dogging mechanisms, ramps, and securing devices shall be operable from outside the elevator trunk. In-trunk hatches, flush deck hatches, their associated dogging mechanisms, ramps, hinged guide rails, and securing devices shall be manually operable from outside the trunk wherever practical. Where manual operation of hatches requires personnel to enter the trunk, a means for safe operator access to the applicable manual operating equipment shall be provided.

3.3.36 Elevator access control. Unless otherwise specified (see 6.2.w), a means for preventing unauthorized access to the elevator trunk and machinery room shall be provided. Trunk access control shall be accomplished as follows:

a. Manually operated elevator trunk doors shall be lockable in the fully closed position from outside the trunk using a padlock.

b. All power operated trunk doors and hatches shall be electrically interlocked as specified in 3.13.3.1.12 and 3.13.3.1.13.

c. Manual operating means for power operated elevator trunk doors and hatches accessible from outside the trunk shall be lockable using a padlock.

d. Solenoids used to operate control valves of hydraulically operated closures shall be lockable by a padlock or shall have covers or cages that can be padlocked to prevent manual operation of the solenoid, unless located in a locked space (see 3.16.1.3). Covers or cages shall have hinged doors to allow for maintenance removal and installation of manifolds.

e. Doors or hatches providing access to the elevator machinery room shall be lockable in the fully closed position from outside the machinery room using a padlock.

3.3.37 Human engineering. The principles of human engineering in MIL-STD-1472 shall be applied to the elevator system design to minimize the possibility of degrading safety or reliability through human error. The elevator system shall be designed for installation, testing, operation, and maintenance by individuals from the 5^{th} percentile female through the 95^{th} percentile male population using the anthropometric and strength requirements of MIL-STD-1472.

3.4 Factors of safety and maximum allowable stresses.

3.4.1 Wire rope. The wire rope safety factor shall be not less than 5 based on the ratio of the minimum breaking strength, in accordance with RR-W-410, to the operating design load (see 6.7.11). When wire ropes are not equally loaded, the factor of safety shall be applied to the most heavily loaded wire rope(s). In cases where the equipment is required to move and support loads at inclined angles, design consideration shall be based on the appropriate vector component of the operating design and holding design loads, as applicable. Wire rope safety factors shall take into consideration the efficiency of wire rope end terminations, as well as bending loads due to sheaves and drums.

3.4.2 Component and structural stress limits. Calculated stresses shall conform to the following:

a. Under equipment operating conditions (operating design load), combined stresses, acting both individually and concurrently for load-bearing mechanical 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 load-bearing mechanical 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 the maximum force of the hoisting machinery, when subjected to the maximum force resulting from application of the brakes or safety devices, or when subjected to the loading design load (see 6.7.9), or tests specified herein, 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 they are substantiated by testing 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 Platform design. The platform shall be a fabricated structure consisting of a frame, safety linkage and guide roller system, and working deck surface designed for raising and lowering mobile handling equipment, stores, cargo, ordnance, or other materials.

3.5.2 Platform performance.

3.5.2.1 Platform rated load capacity. The platform rated load capacity shall be as specified (see 6.2.x). The platform shall support the loading design load, operating design load, and stowed design load (see 6.7.9, 6.7.11, and 6.7.18). The platform shall additionally support the loads imparted on it during the testing specified (see 4.5). The weight of platform safety linkage, guide shoe assemblies, Emergency MEDEVAC enclosures, and other items specified to be mechanically attached to the platform shall be included in the platform assembly weight when applying load factors.

3.5.2.2 Loading design load. The platform shall support mobile handling equipment (see 6.2 m) and rated loads as specified (see 6.2.y) under moderate sea conditions. Unless otherwise specified (see 6.2.l), the platform shall be capable of being loaded from both sides and ends. The effects of powered mobile handling equipment traversing and stopping on the platform during platform loading and unloading operations shall be taken into account as part of the load imposed by handling equipment.

3.5.2.3 Platform deck loading. The platform deck shall support the maximum wheel load of the specified loaded mobile handling equipment during platform loading and unloading operations in moderate sea conditions (see 6.2.g). Possible load combinations and wheel footprints shall be as specified (see 6.2.m and 6.2.y). There shall be no change in physical properties of the platform deck due to fatigue after 250,000 cycles at normal duty cycle (see 3.11.6). One cycle consists of a full loading or unloading evolution of the elevator.

3.5.2.4 Platform deflection. The maximum elastic structural deflections due to elastic deformation under the loading design load condition (see 6.7.9) shall be not greater than 0.5 inch at center of platform and 0.25 inch at any edge. Under the wheel loads of the specified mobile handling equipment, the deck surface shall be permitted up to a 0.125-inch elastic deflection per foot between supports. No permanent deformation of the platform is permitted.

3.5.3 Platform physical characteristics.

3.5.3.1 Weight and dimensions. The platform assembly empty weight, as delivered, including platform safety linkage, guide shoes, and all other attachments thereto, shall not exceed the value specified (see 3.11.1). The platform overall length and width shall be sized as required to provide the platform working deck (see 3.5.3.4). Platform assemblies shall have as shallow a depth as practicable.

3.5.3.2 Platform safety linkage and guide shoes. The platform shall have a safety linkage, broken rope safety devices, and guide shoe assemblies installed in accordance with 3.6.2, 3.7.2, and 803-6397322. There shall be four guide shoe assemblies installed on the platform, arranged to align one guide shoe assembly with each guide rail. A channel of clear space shall be provided at each end of the platform for shafting to interconnect the knurled safety roller assemblies on each guide shoe. The safety linkage system shall be accessible from the underside of the platform for examination, maintenance, adjustment, and replacement. Removable cover panels shall be provided to allow for maintenance of the guide roller assemblies.

3.5.3.3 Buffer spring contact surfaces. The underside of the platform shall include co-planar contact surfaces for elevator buffer springs. The contact surfaces shall be located above the lower surface of the platform to the greatest extent possible to maximize the pit space available for the buffer assemblies. The buffer contact surfaces shall allow for not less than a 0.5-inch clearance between the platform frame and the buffer assemblies when the platform is at the lowest level. There shall be not less than a 1-inch clearance between the elevator platform and the elevator pit structure with the buffer spring assemblies fully compressed.

3.5.3.4 Platform working deck. The platform shall include a flush working deck. The platform working deck shall be made of electrically conductive material having sufficient strength, thickness, and stiffening to meet the requirements of 3.5.2.3 and 3.5.2.4. The platform deck surface shall be flush and shall be provided with a slip-resistant surface in accordance with MIL-PRF-24667, type II, composition G, or PIN code M24667-B1. The platform deck shall be sized and arranged to provide a platform safety margin as specified in 3.21.3, plus a platform safe loading area (see 6.7.13) sized and arranged to conform to the following:

a. Permit loading and unloading of the anticipated elevator payload shapes, as specified (see 6.2.z), through trunk doors and hatches using handling equipment, as specified (see 6.2 m).

b. Permit securing of the anticipated elevator payloads, as specified (see 6.2.aa), on the platform using the platform deck tie-down fittings (see 3.5.3.5) by personnel on the platform within the limits of MIL-STD-1472.

c. Shall not overlap or extend onto the platform safety margin (see 3.21.3).

3.5.3.5 Platform tie-down fittings. The platform deck shall be provided with flush tie-down fittings for use in combination with lashing gear to secure platform payloads within the platform safety margin. All tie-down fittings shall be located within the inner perimeter of the platform safety margin. Payload securing fittings shall be of sufficient quantity, arrangement, and strength to prevent the specified elevator platform payloads from coming adrift in moderate sea conditions, as specified (see 6.2.g). Platform flush deck tie-down fittings shall allow for drainage. Flush deck tie-down fittings shall be as specified (see 6.2.bb) and shall conform to one of the following types:

a. Aircraft securing and engine run fitting, 803-1916300, of welded type compatible with platform working deck.

b. Fitting compatible with tie-down assembly, 804-5184187 or 804-5184191.

c. Other fitting compatible with the tie-down assemblies or lashing gear specified (see 6.2.bb).

3.5.3.6 Platform personnel fall arrest anchorages. When specified (see 6.2.cc), deck fittings compatible with attachment of ANSI/ASSP Z359.1 fall arrest safety lanyards shall be provided on the platform. The fittings shall be compliant with 29 CFR 1910.66 requirements for fall arrest system anchorages. The fittings shall be located not less than 36 inches from the nearest platform edge, or on the platform centerline, whichever is less. Fittings shall allow for drainage. The quantity and arrangement of fall arrest anchorage fittings shall permit access to all parts of the platform deck for maintenance personnel utilizing fall arrest safety lanyards anchored on the platform.

3.5.3.7 Platform liferails. Platform-mounted liferails shall be installed on those edges of the platform working deck not used for loading/unloading operations (see 6.2.l and 6.2.dd) if there exists a gap in excess of 6 inches between the platform edge and the trunk, door, or other structure at any level served. The mounting method for the liferails shall be flush to the deck or outside of the platform edge. Liferails installed on the platform shall be removable. The weight of any portable section shall be compliant with the anthropometric and strength requirements of MIL-STD-1472 for individuals from the 5th percentile female through the 95th percentile male population. In the areas of the trunk requiring frequent access for maintenance to mounted equipment, smaller portable rail sections shall be provided. Deck wells used for liferails shall allow for drainage. Liferails shall not intrude into the safe loading area, as specified (see 3.5.3.4). Liferail installation shall prevent horizontal displacement or rocking of any part of the liferail beyond the platform deck edge, and in no case shall horizontal displacement exceed ±0.375 inch. The height of the top liferail shall be a minimum of 42 inches above the platform deck. The height of the bottom liferail shall be 14 inches above the platform deck. There shall be one equally spaced intermediate liferail. Platform-mounted liferail stanchions shall be 2-inch nominal pipe size, schedule 40 steel pipe or 2⅞-inch outside diameter with 0.203-inch wall aluminum (5086H32) tubing. Horizontal members shall be 1.25-inch nominal pipe size, schedule 40 steel pipe or 1.9-inch outside diameter with 0.2-inch wall aluminum (5086H32) tubing.

3.5.3.8 Emergency MEDEVAC enclosures. When specified (see 6.2.ee), a fixed or portable Emergency MEDEVAC enclosure shall be provided for use on the platform to prevent personnel riding the platform from contacting any portion of the elevator trunk or machinery, from falling off the platform, and to protect personnel from falling objects. Emergency MEDEVAC enclosures shall meet the following requirements when erected on the platform:

a. Be sized to allow maximum practical use of the platform safe load area.

b. Shall not interfere with platform travel or operation of any elevator equipment doors, hatches and ramps, or with any equipment or structures in the trunk.

c. Have an interior clear height of not less than 6 feet, 3 inches.

d. Incorporate manually operated gate(s) on the loading sides of the platform as specified (see 6.2.ee) to provide access to the interior of the enclosure. The gate(s) shall be designed to permit loading and unloading of litter-borne casualties to and from the platform at the specified Emergency MEDEVAC levels. The gate(s) shall be of the sliding or collapsible type and shall not extend beyond the platform deck edge in any position. Latches to secure the gate(s) in both the fully open and fully closed positions shall be provided.

e. Perforations or other openings in the enclosure sides, top, and gates shall be sized to reject a 1.5-inch diameter ball.

f. No portion of the enclosure (including enclosure access gates) shall extend beyond the platform deck edge.

g. The enclosure assembly shall attach to the platform. Fittings used to attach the enclosure to the platform shall not interfere with platform loading and unloading operations.

h. The enclosure shall neither be damaged nor come adrift due to the application of the platform safety linkage during downward high speed travel.

i. The enclosure (including gates and overhead structures) shall withstand a normal force of 75 pounds applied over a 4- by 4-inch area at any point on the enclosure without permanent deformation. Deflection of the enclosure, when subjected to this normal force, shall not reduce the running clearance between the enclosure and equipment or structures in the elevator trunk below 1 inch.

j. If specified to be portable (see 6.2.ee), the enclosure shall be designed to be manually assembled and installed on the platform using hand tools. Stowage shall be provided for all portable enclosure components.

k. If specified to be fixed (see 6.2.ee), the enclosure shall incorporate removable panels to facilitate maintenance access to trunk mounted equipment from the platform.

l. The enclosure shall incorporate brackets inside the enclosure for mounting two portable battery powered battle lanterns.

3.5.3.9 Platform mounted switch vanes. Platform mounted cams, vanes, or similar devices installed for operating trunk-mounted limit switches, proximity switches, and sensing devices shall be rigidly mounted to the platform structure.

3.5.3.10 Platform running clearance. Horizontal clearance between the platform and any deck, trunk structure, trunk closure, wiring, piping, etc., shall be not less than 0.5 inch in all parts of the trunk where the platform may travel (including normal travel and overtravel conditions) when all trunk doors are fully closed. This requirement shall apply throughout the full range of horizontal platform movement permitted by platform guide rollers. This running clearance requirement does not apply to trunk and platform components that are required to contact each other or are required to have smaller running clearance in order to function, such as limit switches and limit switch cams, or guide rollers and guide rail roller faces.

3.5.3.11 Platform power. Unless otherwise approved by the Technical Authority (see 6.7.20), elevator platforms shall not require pneumatic, hydraulic, or electric power.

3.6 Safety devices.

3.6.1 Safety device design requirements. Broken rope safety devices, overspeed governors, overspeed governor slack rope devices, and hoist slack rope devices shall be provided for all elevator installations. Mechanical linkages for 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. Unless otherwise specified (see 6.2 ff and 6.3), a broken rope safety device shall be provided in accordance with 803-6397322. The broken rope safety device shall operate as follows:

a. Breaking of any of the hoisting ropes shall activate the broken rope device, causing the platform safety linkage to wedge the knurled safety rollers against the guide rails to prevent further downward movement of the platform with rated load.

b. The device shall automatically reset for normal elevator operation when hoist tension is restored.

c. The broken rope device and speed governor safety device shall each be able to operate and wedge the knurled rollers independently of the other.

3.6.3 Overspeed governor. An overspeed governor shall be provided and shall comply with the following:

a. The overspeed governor shall be in accordance with 803-6397421.

b. The overspeed governor shall actuate when the downward speed of the elevator platform reaches 140 feet per minute (+10/-0 percent). The actuation of the overspeed governor shall:

(1) Mechanically actuate the platform safety linkage, causing knurled safety rollers to set and arresting the downward movement of the platform.

(2) Electrically de-energize the Safety Interlock Relay (SIR) (see 3.13.3.10) and the Programmable Logic Controller (PLC) SIR (see 3.13.1.3.2.k), if applicable, disconnecting power from the hoist motor and brake (see 3.13.3.1.5).

c. The overspeed governor shall automatically reset and shall permit the platform safety linkage to automatically reset when the elevator platform is jogged upward.

d. The overspeed governor wire rope shall be attached to the platform safety linkage in accordance with 803-6397421.

e. When in-trunk hatches are specified (see 6.2.o), a winding drum (open loop) overspeed wire rope arrangement shall be installed. When a winding drum (open loop) arrangement is utilized, 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. An open loop governor rope shall be of sufficient length to permit raising the platform to the up positive stop position and lowering to the fully compressed buffer spring position and shall have not less than 1½ turns (dead wraps) remaining on the drum.

f. The overspeed governor wire rope shall be 0.25 inch in diameter, either 7 by 19 (independent wire rope core [IWRC]), type I, composition B (stainless steel) in accordance with MIL-DTL-83420 or 6 by 37 (IWRC), stainless steel in accordance with RR-W-410. The overspeed governor wire rope assembly and end fittings shall be in accordance with 803-6397414. The governor wire rope installation shall be in accordance with 0900-LP-008-2010 or T9070-BM-DPC-010/613-1.

g. The overspeed governor trip speed adjustment shall be sealed after calibration and testing. The seal shall prevent readjustment of the trip speed without breaking the seal.

h. Turnbuckles for adjusting the tension and length of the overspeed governor wire rope shall be provided and be accessible from the top of the platform. A means shall be provided to visually verify that overspeed governor wire rope tension is within the appropriate operating tension range of 30 to 60 pounds for open loop systems and 80 to 90 pounds for closed loop systems.

i. The overspeed governor shall be installed in the elevator machinery room.

3.6.4 Overspeed governor slack rope device. An overspeed governor slack rope device shall be incorporated into the overspeed governor assembly in accordance with 803-6397421 and shall de-energize the SIR 115 (see 3.13.3.10) and the PLC SIR (see 3.13.1.3.2 k), if applicable, disconnecting power from the electric hoist motor and brake if the overspeed governor wire rope becomes slack or broken (see 3.13.3.1.6). The overspeed governor slack rope device shall automatically reset for normal elevator operation when the overspeed governor wire rope tension is restored to the operating range.

3.6.5 Hoist slack rope device. A hoist slack rope device shall be provided for each hoist rope. The hoist slack rope device shall operate a proximity switch to de-energize the SIR 115 (see 3.13.3.10) and the PLC SIR (see 3.13.1.3.2.k), if applicable, disconnecting power from the electric hoist motor and brake should any hoisting rope become slack (see 3.13.3.1.7). The hoist slack rope device shall automatically reset for normal elevator operation when the tension is restored. The hoist slack rope device shall be installed in the elevator machinery room. Hoist slack rope devices shall be in accordance with 803-6397416.

3.7 Guide rails and guide shoes. Guide rails shall be provided in the trunk to interact with the guide rollers to prevent platform horizontal movement in excess of that specified in 3.7.2 under all elevator operating, loading, and unloading operations and storm sea conditions as specified in 3.3.2 (see 6.2.f). Guide shoes shall also interact with the guide rails to arrest downward movement of the platform when the broken rope safety device or the overspeed governor safety device actuates the platform safety linkage.

3.7.1 Guide rails. Guide rails and their associated joints, fishplates, mounting foundations, brackets, and fasteners shall withstand the application of the knurled safety rollers of each guide shoe when the safety platform linkage is actuated to arrest downward movement of the platform with rated load at the overspeed governor trip speed. Application of knurled safety rollers in this condition shall not result in damage to the guide rail assemblies or guide rail supports, other than guide rail surface deformations repairable by welding and grinding, and which does not render the elevator inoperable. The design of the knurled roller system and installation of the rails shall be such that, upon application of knurled safety rollers, the rails shall be repairable and any loose rail or bracket fastenings shall have the ability to be properly tightened. Guide rails shall be 30-pound rails in accordance with ASME A17.1/CSA B44, 803-6397409, 803-6397410, and 803-6397411. Guide rails shall be of sufficient length to permit a minimum of 3 inches of overtravel at the top and bottom of elevator travel. Guide rails shall be aligned from top to bottom to within ±0.125 inch center-to-center and face-to-face and plumb in accordance with 803-6397412. Removable fixed stops shall be installed at the top of the guide rails and shall withstand the maximum attainable impact loads when struck by either the moving platform with rated load at rated speed, or the load due to locked rotor torque, whichever is higher. Fixed stops shall prevent the platform from striking any other elevator components or structures and shall prevent guide rollers from traveling past the guide rail ends due to an overtravel event. Guide rails shall be provided with holes for conducting static load testing using the application of a hydraulic static load test device in accordance with 701-6737468.

3.7.2 Guide shoes, guide rollers, and knurled safety rollers. Four guide shoes shall be provided on the platform assembly in accordance with 803-6397322. One guide shoe assembly shall operate on each guide rail throughout the range of platform travel. There shall be one face guide roller, two side guide rollers, and one knurled safety roller per single guide shoe assembly. For elevators having guide rail gaps due to in-trunk hatches, one double guide shoe assembly per guide rail shall be provided on the platform. Each double guide shoe assembly shall include two face guide rollers, four side guide rollers, and two knurled safety roller assemblies. Side and face guide rollers shall be adjustable and spring-loaded to allow for guide rail alignment tolerances. The maximum platform horizontal movement permitted by the side and face guide rollers shall not exceed ±0.375 inch. The knurled safety rollers of each guide shoe assembly shall be connected to and operated by the platform safety linkage.

3.8 Hoisting rope. Wire ropes for raising and lowering the platform shall be pre-stretched, type I, class 3, IWRC, uncoated, extra improved plow steel, right regular lay, and construction 6, 7, or 8 in accordance with RR-W-410. Hoist wire ropes shall be installed using the guidance provided in 0900-LP-008-2010. Hoist wire rope assemblies and end fittings shall be in accordance with 803-6397414 and 803-6397413. The maximum elastic stretch of hoist ropes shall not exceed 0.5 inch between the load and no-load conditions at any level. Hoist rope elastic stretch shall be calculated using the hoist rope modulus of elasticity that most closely corresponds to hoist rope loading when the loading design load is applied. Ropes shall be of sufficient length to permit raising the platform to the up positive stop position and lowering to the fully compressed buffer spring position and shall have not less than 1½ turns (dead wraps) remaining on the drum. Ropes shall be secured to the inside of the winding drums with dead-end clamps as specified on figure 1. Means shall be provided to adjust the length of each rope individually by adjustment nuts on the platform and fittings. Platform end fitting adjustment nuts shall be accessible from alongside or from beneath the platform.

3.9 Buffer spring assemblies. In the event of downward overtravel, the buffer spring assemblies shall completely absorb the energy of the platform with the rated load traveling in overspeed up to the governor trip velocity (see 3.6.3). The buffer springs shall have sufficient stroke to absorb this kinetic energy and prevent the platform from contacting the spring housing positive stops. Buffer springs shall be aligned with platform buffer spring contact surfaces. Retainers shall be provided to prevent buffer springs from coming ajar from their housings. Buffer spring housings shall allow for drainage.

3.10 Sheaves. Sheaves shall be provided to guide the hoisting ropes and overspeed governor wire rope. Depth, throat, rim thickness, neck, and groove diameters of sheaves shall be in accordance with T9070-BM-DPC-010/613-1. The pitch diameter of rotating sheaves shall be as large as practicable, but shall be not less than 18 times the wire rope diameter. The pitch diameter of platform-mounted non-rotating sheave segments shall be not less than 12 times the wire rope diameter. Sheaves shall have removable rope guards to prevent the rope from being displaced from the rope groove of the sheave. Hoist sheaves shall be mounted on anti-friction roller bearings. For hoist sheaves, 803-6397423 and 803-6397424 may be used for guidance. For overspeed governor deflection sheaves, 803-6397422 may be used for guidance. The fairlead angle between any two sheaves shall be not greater than 1½ degrees in accordance with T9070-BM-DPC-010/613-1.

3.11 Hoisting machinery.

3.11.1 Hoisting machinery classes. The hoisting machinery operational weight classes shall be determined using table VI, as specified (see 6.2.b and 6.2.x).

TABLE VI. Hoist machinery classes.

Weight class	Maximum platform rated load (pounds)	Maximum platform weight (pounds)	Additional dynamic load 50% of rated load (moderate sea factor – pounds)	Minimum hoist capability (pounds)
1	Not to exceed 6,000	Not to exceed 6,000	Not to exceed 3,000	15,000
2	Not to exceed 12,000	Not to exceed 8,500	Not to exceed 6,000	27,000
3	Not to exceed 16,000	Not to exceed 11,500	Not to exceed 8,000	36,000

3.11.2 Characteristics. The hoisting machinery shall be an electric motor-driven geared assembly for hauling in and paying out wire ropes reeved to the elevator platform. The hoisting machinery shall safely raise and lower the loaded platform, as well as bring it to a complete stop and hold the load from either direction of travel. The elevator platform shall be suspended from the hoist machinery by four wire ropes, single part reeving. The elevator hoist machinery shall have the capability to operate through two complete cycles of hoist and lower operation throughout the full operating vertical range at maximum attainable speed with 150 percent of rated load on the platform without exceeding stress limits as specified in 3.4.2.a. The elevator hoist machinery shall be designed to withstand the greater of the braking torque of 3.11.3.3, the static torque of 3.11.3.9, or the stall torque of the electric motor (see 3.11.3.7 or 3.11.3.8) without exceeding the stress as specified in 3.4.2.b for any component. Provision for maintenance and lubrication of the machine elements, as well as access to the hoist machinery brake manual release, shall be provided from the perimeter of the assembly opposite the hoisting rope drums. The hoisting machinery assembly shall consist of the following major elements:

a. Reversible electric hoist motor
b. Speed reducer
c. Hoisting wire rope drums
d. Overspeed governor wire rope drum (where required by in-trunk hatch)
e. Hoist machinery brake
f. Hoist machinery bedplate
g. Drum shaft pillow blocks
h. Drum shafts
i. Couplings

3.11.3 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 table VI. Elevator high speed travel shall be at 100 feet per minute (+10/-0 percent) and slow speed shall be at 16.7 feet per minute (+13/-0 percent). The hoist machinery shall operate as specified in 3.11.3.1 or 3.11.3.2. The hoist machinery shall repeatedly perform as described when subjected to the duty cycle specified in 3.11.6. The hoist machinery shall allow for manual lowering of the platform through operation of the hoist machinery brake manual release as specified in 3.11.3.9.

3.11.3.1 Two-speed hoist machinery performance. Elevators utilizing a two-speed motor shall operate as follows. In dispatch mode, the hoisting machinery shall be energized to start in high speed and raise or lower the platform to the desired deck level. A short distance from its destination, the motor high speed windings shall be de-energized and the low speed motor windings shall be energized, decelerating the platform to slow speed. Then, at the desired level, the brake and motor low speed windings shall be de-energized, causing the brake to stop and hold the platform. In the jog mode, hoisting machinery shall be energized to operate in low speed only and traverse the platform at slow speed in the up or down direction while the corresponding jog button is depressed.

3.11.3.2 Variable speed hoist machinery performance. Elevators utilizing variable speed motors shall operate as follows. In dispatch mode, the motor drive shall first sequence through torque proving, then release the brake and accelerate the motor to high speed within 1 second to raise or lower the platform to the desired level. A short distance from the destination level, the motor drive shall smoothly decelerate the motor to low speed within approximately 1 second. When the desired level is reached, the drive shall decelerate the hoist motor to zero speed, de-energize the brake, and then de-energize the motor. In jog mode, while the JOG UP or JOG DOWN pushbutton is depressed, the motor drive shall first sequence through torque proving, then release the brake and accelerate the motor to low speed within 1 second to raise or lower the platform to the desired level. When the desired level is reached, the drive shall decelerate the hoist motor to zero speed, de-energize the brake, and then de-energize the motor. Hoisting machinery shall be energized to operate in low speed only and traverse in the up or down direction while the corresponding jog button is depressed.

3.11.3.3 Stopping performance.

3.11.3.3.1 Normal stop performance. The hoisting machinery shall stop and hold a fully loaded platform within 0.25 inch of desired position in moderate sea conditions (see 3.3.3). This requirement shall be applied to both upward and downward travel.

3.11.3.3.2 High speed stop performance. The hoisting machinery shall bring the platform, loaded with 150 percent of rated load, traveling at a speed of 100 feet per minute in the downward direction, to a full stop within 3 linear feet of travel after power is removed from the motor and brake to simulate an emergency stop of a loaded platform in moderate sea conditions (see 3.3.3).

3.11.3.4 Hoisting drums.

3.11.3.4.1 Drum arrangement. Hoisting drums shall be suitably furnished 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 5). Where practicable, one pair of hoist drums shall be arranged on each side of the speed reducer. When a winding drum overspeed governor is required to allow operation with in-trunk hatches, the overspeed governor drum shall be arranged on the hoist drum shaft as shown on figures 2, 3, or 4.

3.11.3.4.2 Hoisting drum diameter. The hoisting drum diameter shall be selected concurrently with the speed reducer ratio (see 3.11.3.6) to allow the elevator to travel at 100 feet per minute with the motor operating at 1,700 revolutions per minute (rpm). The minimum hoist drum pitch diameter shall be not less than 30 times the diameter of the hoist wire rope. The maximum deviation in pitch diameter between each drum shall be 0.006 inch.

3.11.3.4.3 Hoisting drum configuration. Drum width and groove proportions are functions of the rope size specified for the elevator served and the platform travel. Rope storage capacity shall permit raising the platform to the up positive stop position and lowering to the fully compressed buffer spring position and shall have not less than 1½ turns (dead wraps) remaining on the drum. The hoisting drums shall be grooved and of sufficient size to store the hoisting rope in one layer without the rubbing of one part of wrap of rope against another. The drums shall be proportioned in accordance with figure 5 and T9070-BM-DPC-010/613-1. The hoist wire rope drum dead end clamp shall be mounted on the exterior of the hoisting drum in accordance with figure 1, which allows it to be adjustable for free length to permit platform leveling. The maximum fleet angle between the hoisting drum and the first fairlead sheaves shall be not greater than 1½ degrees (see T9070-BM-DPC-010/613-1).

3.11.3.4.4 Overspeed governor drum. When an open loop overspeed governor system is installed due to the presence of in-trunk hatches, an overspeed governor drum shall be installed on the hoist drum shaft with the same pitch diameter and tolerance as the hoisting drum, and be grooved for a 0.25-inch diameter wire rope. The rope storage capacity of the overspeed governor wire rope drum shall permit raising the platform to the up positive stop position and lowering to the fully compressed buffer spring position and shall have not less than 1½ turns (dead wraps) remaining on the drum. The overspeed governor wire rope drum dead-end clamp shall be as shown on figure 1.

3.11.3.5 Hoist machinery safety guards. All exposed rotating machinery, including shafts, couplings, and wire rope drums, shall be furnished with metal guards. The guards shall permit visibility of components and shall be removable. 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 sufficient to prevent inadvertent contact with rotating parts and pinch points. Assembled guards shall not deflect into rotating machinery when subjected to a force of 75 pounds applied over a 4- by 4-inch area perpendicular to the guard. Guards on hoist drums shall not prevent examination of hoist rope reeving on hoist drums. Guards shall not obstruct access to, or operation of, the hoist machinery brake manual release or any other operator controls.

3.11.3.6 Speed reducer. An enclosed, single housing, triple reduction (or greater) speed reducer shall be furnished. The speed reducer shall be in accordance with ANSI/AGMA 6001 and ANSI/AGMA 6013. The reduction ratio shall allow the elevator speed to be 100 feet per minute with the motor speed at 1,700 rpm. 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 hoist motor on one side, and the hoist machinery brake on the other. The speed reducer case shall have a flange mount for this brake (see 3.11.3.9). Provision for the brake mounting shall include an alignment pilot and a hole pattern for bolting. Where practicable, the low speed output shaft shall be double extended to permit each shaft to drive a pair of hoisting drums. One side of the output shaft shall also drive the overspeed governor drum if a winding drum governor is required (see 3.11.3.4.1).

3.11.3.6.1 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 Q7 or better in accordance with AGMA 915-1, AGMA 915-2, AGMA ISO 1328-1, and ANSI/AGMA 2015-2. The speed reducer shall be capable of reacting to axial thrust loads and overhung radial loads resultant from the operating design load. Additionally, the speed reducer shall be capable of reacting to axial thrust loads and overhung radial loads resultant from the elevator being subjected to an emergency stop while traveling downward at rated speed with 150 percent of rated payload on the platform. The minimum service factor shall be 1.75 in accordance with ANSI/AGMA 6001. 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-DTL-24441.

3.11.3.6.2 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-PRF-2765. Shaft seal packing shall be replaceable without removing the associated shaft.

3.11.3.6.3 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 that indicates oil level shall be provided. The dipstick shall be marked to indicate the “full” and “add oil” levels with the amount of oil between the two positions noted. The oil fill access to the dipstick shall be located on the gear case and 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. Circulation of oil through the bearings and gears shall 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).

3.11.3.6.4 Lubricants. When grease-lubricated, a seal shall be provided to prevent the oil and grease from 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 SAE J2360, grade 80W90. Grease requirements shall be consistent with DOD-G-24508.

3.11.3.7 Two-speed electric hoist motor. When a two-speed motor controller is specified (see 6.2.hh), a two-winding electric hoist motor shall also be provided in accordance with MIL-DTL-17060 and the following requirements:

a. Service: Service A
b. Ambient temperature: 32 to 122 °F (0 to 50 °C)
c. Ambient humidity: 95 percent at 90 °F
d. Voltage: 440 volts alternating current (VAC)
e. Phase: 3
f. Frequency: 60 hertz

g. Duty:

(1) Number of starts: 30 per hour

(2) Time frame for one complete duty cycle:

(a) Accelerate from zero speed to high speed with an assisting overhauling torque of 150 foot-pounds (ft-lbs) (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1 second.

(b) Run at high speed for approximately 44 seconds with an assisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3).

(c) Decelerate from high speed to low speed with a resisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1.4 seconds.

(d) Remove power and brake to a stop.

(e) Pause for 75 seconds.

(f) Reverse motor direction of rotation.

(g) Accelerate from zero speed to high speed with a resisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1 second.

(h) Run at high speed for approximately 42 seconds with a resisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3).

(i) Decelerate from high speed to low speed with an assisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1 second.

(j) Remove power and brake motor to a stop within 1 second.

(k) Pause for 75 seconds.

(3) Maximum periods and sequence of times the duty cycle will be imposed in a 24-hour period: Continuous

(4) The motor shall be capable of running 24 minutes per hour at high speed and 5 minutes per hour at low speed.

h. Connected inertia at shaft: 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-up 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: Stator windings shall be provided with thermal sensors in accordance with MIL-DTL-17060.

n. Enclosure: Drip-proof, protected (DPP)

o. Horsepower: 75 (class 1), 100 (class 2), 150 (class 3)

p. Speed: Two-speed (1,800 rpm and 300 rpm) from two separate windings

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-1474, category D and MIL-STD-740-2, type II

x. Locked rotor torque: Not less than 275 percent of high speed full load torque

y. Capable of accelerating and decelerating as specified in 3.11.3.7.g, above, by applying 440 (±10 percent) VAC, 60 hertz to the high or low speed windings, as applicable

3.11.3.8 Variable speed electric hoist motor. When a variable frequency drive is specified (see 6.2 hh), a single-winding electric hoist motor capable of being operated at variable speed shall be in accordance with MIL-DTL-17060 and the following requirements:

a. Service: Service A

b. Ambient temperature: 32 to 122 °F (0 to 50 °C)

c. Ambient humidity: 95 percent at 90 °F

d. Voltage: 440 VAC

e. Phase: 3

f. Frequency: 0-60 hertz

g. Duty:

(1) Number of starts: 30 per hour

(2) Time frame for one complete duty cycle:

(a) Accelerate from zero speed to high speed with an assisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1 second.

(b) Run at high speed for approximately 44 seconds with an assisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3).

(c) Decelerate from high speed to the specified low speed with a resisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1.4 seconds.

(d) Decelerate to zero speed within 1 second to stop and apply the brake.

(e) Pause for 75 seconds.

(f) Reverse motor direction of rotation.

(g) Accelerate from zero speed to high speed with a resisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1 second.

(h) Run at high speed for approximately 42 seconds with a resisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3).

(i) Decelerate from high speed to the specified low speed with an assisting overhauling torque of 150 ft-lbs (class 1), 250 ft-lbs (class 2), 330 ft-lbs (class 3) within 1 second.

(j) Decelerate to zero speed within 1 second to stop and apply the brake.

(k) Pause for 75 seconds.

(3) Maximum periods and sequence of times the duty cycle will be imposed in a 24-hour period: Continuous

(4) The motor shall be capable of running 24 minutes per hour at high speed and 5 minutes per hour at low speed.

(5) The motor shall be capable of maintaining 200 percent full torque at zero speed for 2 seconds.

h. Connected inertia at shaft: 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-up 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: Stator windings shall be provided with thermal sensors in accordance with MIL-DTL-17060.

n. Enclosure: DPP

o. Horsepower: 75 (class 1), 100 (class 2), 150 (class 3)

p. Speed: 0-1,800 rpm

q. Type: Squirrel cage induction

r. Design: A

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-1474, category D and MIL-STD-740-2, type II

x. Locked rotor torque: Not less than 275 percent of high speed full load torque

y. Encoder:

(1) Integral to the motor frame

(2) Modular digital

(3) Frequency response 0-120 kilohertz

(4) Input voltage 5.0-15.0 volts direct current (VDC)

(5) Magneto resistive sensor based

(6) 1024 or 2048 pulses per revolution, bidirectional

(7) Square wave output

(8) Channels A, B (incremental), Z (marker)

(9) Outputs designated as follows:

(a) Shield

(b) Common

(c) 5-15V

(d) A

(e) A(not)

(f) B

(g) B(not)

(h) Z

(i) Z(not)

(10) Cannon plug connector

z. The motor shall be compatible with the variable speed drive specified in 3.13.1.2.

3.11.3.9 Hoist machinery brake. The hoist machinery brake shall be attached to the speed reducer high speed pinion shaft (see figures 2, 3, or 4). The brake shall be of the disc type and shall be spring set, electrically released, and shall conform to MIL-DTL-16392 and the following requirements:

a. Torque: The brake shall be capable of stopping platform motion and machinery rotation, including de-energized motor rotor inertia, when loaded with 150 percent of rated load from slow speed (see 3.11.3) in less than ¼ rotation of the brake shaft. The brake shall be capable of stopping the platform motion and machinery rotation, including de-energized motor rotor inertia, when loaded with 150 percent of rated load traveling downward at high speed (see 3.11.3) within a distance of 3 feet of platform travel. The brake thermal capacity shall be sufficient to allow such a dynamic stop once every two hours. The brake shall be capable of holding the platform and hoist machinery without slippage with a static load of 200 percent of rated load or 400 percent of rated load if forklift-loaded (see 4.5.5 and 6.2.m).

b. Supply voltage: 440-VAC, three-phase, 60-hertz

c. Duty: 30 slow speed stops per hour

d. Mounting: Horizontal speed reducer high speed pinion shaft, flange

e. Enclosure: DPP

f. Brake coil: Class H insulation

g. Rotating brake discs shall be provided with heavy duty lining bonded to a bronze carrier ring. Asbestos shall not be used.

h. Stationary discs and pressure plate shall be nodular or ductile iron in accordance with MIL-C-24707/5.

i. 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 a high speed stop.

j. Brake overheating shall not cause damage other than brake lining wear.

k. Brake 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 limitations 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 the requirements for grade A shock in accordance with MIL-DTL-901 while de-energized.

q. The brake 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.

r. The brake shall include a manual brake release mechanism. The manual brake release shall be operable by one person without the use of tools and without disassembly of any portion of the hoist machinery. Operation of the brake release shall be through a single lever or handle. The brake release shall not be detented, shall not latch in any position, and shall be spring returned. The brake shall re-engage when manual input to the brake release is discontinued. The brake manual release shall permit manually controlled lowering of the elevator platform without the use of tools, electric power, or any additional equipment not part of the elevator.

s. The brake shall include a brake wear sensor that shall provide an electric signal to the elevator control system to indicate when brake linings need replacement.

3.11.3.10 Couplings. The hoist machinery electric motor shall be connected to the speed reducer through a flexible coupling. For hoist machinery arrangements in which the hoist drums are not mounted directly on the speed reducer low speed shaft, the hoist drum shafts shall be connected to the speed reducer low speed shaft by flexible couplings. 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. Hoist machinery couplings shall have a minimum service factor of not less than 2.0 in accordance with AGMA 922. Grease lubrication shall be provided by high pressure grease fittings and vents.

3.11.3.11 Hoisting drum shafting and bearings. Bearings shall be provided to support the hoist drum shafting (see figures 2, 3, and 4 for guidance). The shafting shall be mounted in self-aligning, spherical roller bearings in accordance with ABMA 20, ABMA 24.1, or ABMA 24.2. All bearings shall be double shielded and shall be fitted with high-pressure grease fittings and vents. When practicable, bearings shall be arranged on each side of the drums. 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. Speed reducer low speed shaft bearings shall be used as the inboard drum shaft bearings in arrangements where drums are mounted directly to the low speed shaft. All other bearings used to support drums shall be in split housing type pillow blocks. Pillow block foundations shall be mounted on the hoist machinery bedplate where practicable.

3.11.3.12 Bedplate. The speed reducer and hoist motor shall be mounted on a common bedplate. The bedplate shall be rigid enough to maintain alignment of machinery mounted thereon when subjected to the maximum force reactions from the application of the brake (see 3.11.3.9), safety devices (see 3.6), design stresses (see 3.4.2), or tests specified (see 4.2 and 4.3) whichever is greatest, without aid from the deck foundation. When practicable, the drum shaft pillow bocks shall be mounted on the same bedplate as the speed reducer and hoist motor. Machinery mounting surfaces shall be completely machined. The bedplate shall be fabricated from steel in accordance with MIL-S-22698 or T9074-BD-GIB-010/0300.

3.11.4 Physical characteristics. The hoist machinery assembly shall be configured as depicted on figures 2, 3, or 4.

3.11.5 Dimensional limitations. The hoist machinery assembly shall not exceed the dimensional limits shown on figures 2, 3, or 4.

3.11.6 Duty cycle. All elements of the hoist 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: 30 per hour

b. Time frame for one complete duty cycle: average 100 feet/minute down for 72 feet, then 19 inches at slow speed with a 75-second wait and 100 feet/minute up for 72 feet, then 19 inches at slow speed with a 75-second wait

c. 24-hour period: 10-hour continuous duty

d. The machinery shall be capable of operating 24 minutes per hour in high speed and 5 minutes per hour at slow speed.

3.12 General requirements for electrical equipment.

3.12.1 Electrical equipment. All major electrical equipment shall operate from a 440-VAC, 60-hertz, three-phase ungrounded, type I power system having steady-state and transient characteristics in accordance with MIL-STD-1399-300-1. Electrical equipment shall be in accordance with MIL-DTL-917.

3.12.1.1 Electromagnetic compatibility. The elevator system shall be in accordance with MIL-STD-461 for surface ships, metallic hull.

3.12.1.2 Electrical enclosures. Unless otherwise specified (see 6.2.gg), enclosures for electrical equipment shall be in accordance with MIL-STD-108 and as follows:

a. Watertight for all control stations and electrical equipment exposed to weather or located in elevator trunks, hangar bays, well decks, magazines, ammunition handling spaces, or areas subject to sprinkler systems or hosing.

b. Explosion-proof for equipment that is confined in a space where explosive atmospheres may exist (see 6.2.i).

c. Drip-proof for all other electrical equipment enclosures.

3.12.1.3 Grounding and bonding. All elevator equipment shall be grounded and bonded in accordance with MIL-STD-1310.

3.12.1.4 Cable and cable connections. Cable and cable connections shall be in accordance with MIL-DTL-24643 and MIL-STD-2003. Cable shall be shielded as needed to meet electromagnetic compatibility and electromagnetic interference requirements in accordance with MIL-STD-461.

3.12.1.5 Cable connectors. Cable connectors shall be in accordance with SAE AS50151.

3.12.1.6 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 troubleshooting purposes. Junction boxes shall be as specified in 3.12.1.2.

3.12.1.7 Cable feed-through. Cable feed-through for all controllers, control stations, and electrical enclosures shall be in accordance with MIL-S-24235.

3.12.1.8 Terminal boards. Terminal boards shall be in accordance with one of the following:

a. A-A-59125/1

b. A-A-59125/3

c. A-A-59125/16

d. A-A-59125/20

e. A-A-59125/21

f. A-A-59125/24

3.12.1.9 Wire markings. All wires inside controllers and junction boxes shall be permanently identified in accordance with MIL-STD-681 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 platform (logic) controller, single flush hatch controller or dual 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), hangar deck control station (for elevators serving hangar decks), deck level control stations, and a power disconnect switch. The elevator control system shall also include a two-speed motor controller or variable speed drive, as specified (see 6.2.hh). Elevators utilizing Hybrid Relay Logic Control and having a single hatch shall have a hatch controller. Elevators utilizing Hybrid Relay Logic Control and having two hatches shall have a dual hatch controller. Elevators utilizing Solid-State Programmable Logic Control shall incorporate the functions of the hatch controller or dual hatch controller, as applicable. The elevator control system shall be in accordance with the applicable NAVSEA drawing in table VII. All devices requiring operator interface, including switches, indicators, etc., and all switches located inside the elevator trunk shall be labeled using the nomenclature specified herein and as found in the applicable NAVSEA drawing in table VII. Labeling shall be in accordance with 3.32.

TABLE VII. Control system reference drawings.

Elevator configuration	NAVSEA drawing No.
No hatch	803-8436628
Single hatch	573-6723831
Dual hatch (one flush, one in-trunk)	573-6723830

3.13.1.1 Two-speed motor controller. The motor controller shall be located in the machinery room and shall be in accordance with MIL-DTL-2212 and 3.13.1. When a two-speed motor controller is specified (see 6.2 hh), a two-speed motor (see 3.11.3.7) shall be provided. A two-speed AC magnetic size 5 motor controller shall control the motor and brake for Class 2 and 3 elevators; a two-speed AC magnetic size 4 motor controller shall control the motor and brake for Class 1 elevators. The directional contactors shall be mechanically and electrically interlocked so that UP and DOWN cannot be activated simultaneously. The speed contactors shall be mechanically and electrically interlocked so that HIGH and LOW cannot be activated simultaneously.

3.13.1.2 Variable speed drive. When a variable speed drive is specified (see 6.2 hh), a variable-speed motor (see 3.11.3.8) shall be provided. A programmable variable speed drive in accordance with MIL-PRF-32168 and the following shall be used to control the motor and brake:

a. The drive shall be compatible with the variable speed motor and motor performance specified in 3.11.3.8.

b. The drive shall provide regenerated power to the input source during dynamic braking compliant with the power quality requirements of MIL-STD-1399-300-1.

c. The drive shall be provided with a communication port to allow communication and control via the elevator PLC as specified in 3.13.1.3.2.

d. The drive shall be provided with a torque proving circuit to verify hoist motor load-holding capability prior to releasing the hoist machinery brake. The torque proving circuit shall not permit the hoist machinery brake to be electrically released until the hoist motor has developed sufficient torque to positively control the load.

e. The drive shall be provided with a torque holding circuit such that the drive deceleration rate shall completely bring the hoist motor rotation to zero speed while holding the load prior to de-energizing the hoist machinery brake solenoid. The torque holding circuit shall only hold the hoist motor at zero rotational speed to ensure that the hoist machinery has stopped rotation before setting the hoist brake.

f. The drive shall utilize a closed loop vector control of the variable speed motor specified in 3.11.3.8.

g. The drive shall be configured to permit emergency jog operation of the elevator platform in the event of a PLC fault or failure as specified in 3.13.3.9.

h. The drive shall be air-cooled or incorporate a self-contained, closed-loop fluid cooling system. The drive shall not require connection to external fluid systems for cooling.

i. The drive shall have a safety interlock that will remove all electric power from the motor bridge and the brake when the SIR 115 (see 3.13.3.10), and the PLC SIR (see 3.13.1.3.2 k), if applicable, circuit is de-energized.

j. The drive system shall be able to provide a fail-safe shutdown in the event of a power failure, or de-energizing of the power disconnect switch (see 3.13.1.11). Failure of any hardware, firmware, network communication, or SIR 115 (see 3.13.3.10), and the PLC SIR (see 3.13.1.3.2 k), if applicable, shall fail-safe platform motion. The drive shall meet these requirements during motoring, regeneration, and idling without incurring damage to any drive components. The drive system shall be capable of returning to a normal operational readiness condition upon fault or failure resolution.

k. The drive shall be microprocessor-controlled.

l. The drive system shall store drive programs and programmable parameters in removable non-volatile memory.

m. The drive shall include an operator interface that provides real-time display of drive status, faults, input and output state, and drive parameters. The operator interface shall allow adjustments to be made to programmable parameters of the drive and check the valid syntax and semantics of inputs such as character set, length, numerical range, and acceptable values.

n. The drive shall display warning and fault indications for overtemperature, undervoltage, overcurrent, overvoltage, ground fault, and communication loss.

o. The drive shall employ anti-tamper technologies to prevent physical tampering or alteration.

p. Drive programmable features shall be capable of being password protected to prevent unauthorized modification.

q. The drive shall incorporate parameter file and hardware identification checks that shall prevent operation of the drive using incompatible software. The software-hardware checks shall verify that drive software matches the drive configuration at startup. In the event a software program does not match the drive configuration, the incompatible software shall not be executed and a fault message identifying the incompatible software shall be accessed through the diagnostic terminal.

r. The drive system shall operate with a supply power factor of 0.8 lagging to 0.95 leading. The power factor of the network bridge shall be 1.0 to 0.95 lagging for motoring and regenerating.

s. The drive system shall provide variable speeds utilizing a single winding motor. The drive shall be programmable to allow motor speeds of zero to 1800 rpm. The speed holding accuracy shall be 0.02 percent of full speed from zero to 100 percent motor load. The drive shall not require an external braking resistor to maintain speed regulation requirements.

t. The drive system shall provide diagnostic capabilities to allow faults to be isolated to the lowest replaceable unit or module. Diagnostics shall be of power up and on-line type. The drive shall display the diagnostic result, the status of selectable addresses, and the list of suspected modules that could cause the failure. The elimination of suspected failed modules shall be a maximum of three of the most likely modules that could cause that particular failure.

u. Unless otherwise specified (see 6.2.ii), network communications, if used between the drive and other devices forming part of the elevator system, shall utilize an open architecture network communications protocol.

v. The drive shall be provided with an Ethernet port in accordance with MIL-DTL-32613. This port shall allow monitoring, troubleshooting, adjustment of programmable parameters, and upload or download of drive software via a portable computer utilizing the operating system software, as specified (see 6.2.jj). All Ethernet communication to and from the drive shall be compatible with the network communication protocols, as specified (see 6.2.mm).

w. A hinged or removable cover shall be provided to protect the port from unauthorized access when it is not in use.

x. All drive status, diagnostic and fault information, troubleshooting features, and programmable parameter adjustments shall be accessible through the machinery room diagnostic terminal.

y. The drive shall be capable of operating the hoist machinery brake specified in 3.11.3.9. The drive shall have a dedicated brake output that is hardwired to the coil of the hoist machinery brake.

z. The drive shall be capable of maintaining 200 percent of full torque at zero speed for 10 seconds.

aa. Motor speed shall be monitored independently from the drive. The monitoring device shall provide contacts that shall be closed when the motor command (drive output frequency) is equivalent to high speed. These contacts shall be used in conjunction with the terminal level up high speed stop switch (see 3.13.3.1.8), terminal level down high speed stop switch (see 3.13.3.1.9), hatch sequence up high speed stop switch (see 3.13.3.1.10), and hatch sequence down high speed stop switch (see 3.13.3.1.11) to interrupt the closed-loop power disconnect circuit (see 3.13.3.11) if the motor command (drive output frequency) is not in low speed.

3.13.1.3 Platform (logic) controller. The platform controller shall operate from 115-VAC power supplied from the motor controller and shall have an ungrounded 24-VDC power supply. Unless otherwise protected, the 24-VDC high and power common shall be fused separately in accordance with MIL-PRF-15160. The platform controller shall employ either Hybrid Relay Logic Control or Solid-State Programmable Logic Control methods as specified (see 6.2.c).

3.13.1.3.1 Hybrid relay logic control. Hybrid Relay Logic Controllers, where used, shall be in accordance with the applicable drawings listed in table VII.

3.13.1.3.2 Solid-state programmable logic control. Where Solid-State Programmable Logic is used, the PLC shall perform all elevator platform, door, and hatch logic functions, and shall conform to MIL-DTL-32613 and the following:

a. The applicable NAVSEA drawings listed in table VII shall be used as guidance for developing PLC project files (see 6.7.14).

b. Failure of the PLC shall not disable or interfere with the fail-safe operation of the power disconnect safety circuit (see 3.13.3.11) and SIR 115 circuit (see 3.13.3.10).

c. The PLC shall not replace any functionality of the power disconnect safety circuit or SIR 115 circuit.

d. The PLC shall employ anti-tamper technologies to prevent physical tampering or alteration.

e. PLC programmable features shall be capable of being password protected to prevent unauthorized modification.

f. The PLC shall incorporate identification checks that shall prevent operation of the PLC using an incompatible project file. The project file-hardware checks shall verify that the project file matches the PLC configuration. In the event a project file does not match the PLC configuration, the project file shall not be executed at startup and a fault message shall be accessible through the diagnostic terminal.

g. The PLC shall contain removable non-volatile memory for the storage of the elevator usage data, the project file, and parameters.

h. The PLC shall be supported by a diagnostic terminal as specified in 3.13.1.12. All PLC status, diagnostic and fault information, troubleshooting features, and programmable parameter adjustments shall be accessible through the diagnostic terminal.

i. All elevator switches, relays, and sensors shall be configured to provide individual inputs to the PLC.

j. The PLC shall provide elevator system diagnostics to isolate faults or failures down to the lowest replaceable module level. Fault status outputs from devices forming part of the elevator system shall be configured as individual inputs to the PLC. Additionally, the PLC processor, communications modules, and input/output (I/O) modules shall provide a self-diagnostic capability. Diagnostics shall be of the power up and continuous type. Failure of the processor, any communication device, I/O module, or communication network shall result in failure of the PLC to provide or maintain an output bit labeled PLC Ready. PLC Ready is an indication of the system health of the logic controller and its network and shall be an input to the PLC SIR circuit (see 3.13.1.3.2 k).

k. The elevator project file shall incorporate all of the SIR 115 circuit inputs (see 3.13.3.10) utilizing the inputs (see 3.13.1.3.2.i) to complete a run permissive condition labeled PLC SIR. Failure of any SIR 115 input or logic controller health (see 3.13.1.3.2.j) shall result in a PLC SIR failure. The PLC SIR output shall be hardwired as an input to the SIR 115 circuit (see 3.13.3.10).

l. Unless otherwise specified (see 6.2.ii), network communications between the PLC and other devices forming part of the elevator system shall utilize an open architecture network communications protocol and be configured in accordance with DoDI 8551.01. The PLC shall monitor the fault status of all network communications between the PLC and other devices forming a part of the elevator system.

m. The PLC shall be provided with a dedicated Ethernet network port in accordance with MIL-DTL-32613 to allow monitoring of elevator status and elevator usage data information (see 3.25) via a portable computer utilizing the operating system software and network communication protocols, as specified (see 6.2.ii).

n. The PLC enclosure shall include an external Ethernet port in accordance with MIL-DTL-32613. This port shall allow selection and display of all elevator system status, diagnostic, and troubleshooting information via a portable computer utilizing the operating system software and communication protocols, as specified (see 6.2.jj). This port shall additionally allow adjustment of elevator system programmable parameters, upload and download of all elevator project files, and download of elevator usage data. This port shall be accessible without opening or accessing the interior of the PLC enclosure.

o. The PLC shall manage inadvertent operations in accordance with Appendix C.

p. If the laser sensor (see 3.13.3.15) is provided, the PLC shall calculate absolute platform velocity and de-energize the PLC SIR (see 3.13.1.3.2 k) output if the platform velocity exceeds 130 feet per minute.

q. If the laser sensor (see 3.13.3.15) is provided, the laser shall provide a healthy hardware bit to the PLC. Failure to receive the healthy status bit shall de-energize the PLC Ready relay (see 3.13.1.3.2.j), thereby canceling commanded motion and precluding any additional commanded motion by opening the PLC SIR (see 3.13.1.3.2 k) circuit.

3.13.1.4 Dual hatch or single hatch controller. A dual hatch or single hatch controller shall be incorporated into the control system of an elevator having in-trunk automated or sequencing hatches. The hatch controllers shall be in accordance with the appropriate NAVSEA drawing specified in table VII. The dual hatch or single hatch controller shall be located in the machinery room. Where Solid-State Programmable Logic Control is utilized, the PLC shall perform all functions of the dual hatch or single hatch controller, as applicable.

3.13.1.5 Machinery room control station. A machinery room control station with functionality in accordance with the appropriate NAVSEA drawing specified in table VII shall be provided in the machinery room, separate from the motor controller with an unobstructed view of the hoist machinery.

3.13.1.6 Master control station. A master control station with functionality in accordance with the appropriate NAVSEA drawing specified in table VII shall be provided at a deck level, as specified (see 6.2.kk), in close proximity to the trunk access. Additionally, a MOTOR OVER TEMPERATURE red indicator light shall be provided on the master control station and shall be operated by the motor temperature monitoring circuit and the embedded sensors in the stator windings (see 3.11.3.7 and 3.11.3.8). All control station elements shall be panel mounted within a lockable (by separate padlock) enclosure. The master control station shall be arranged such that the operator can observe operation of elevator closures and loading/unloading operations at that level for the associated elevator.

3.13.1.7 Master control station (dual hatch ships only). Elevators serving the hangar bays via a door shall be provided with a hangar deck control station with functionality in accordance with the 573-6723830 master control station without jog controls. Elevators serving the hangar bay with a flush deck hatch shall be provided controls as specified in 3.13.3.1.16 and 3.13.3.4 in lieu of door controls. Elevators that do not have a deck level control station at the hatch sequence level shall be provided an UNSTOW pushbutton at the master control station. Additionally, a MOTOR OVER TEMPERATURE red indicator light shall be provided on the master control station and shall be operated by the motor temperature monitoring circuit and the embedded sensors in the stator windings (see 3.11.3.7 and 3.11.3.8). All control station elements shall be panel mounted within a lockable (by separate padlock) enclosure. The master control station shall be arranged such that the operator can observe operation of elevator closures and loading/unloading operations at that level for the associated elevator.

3.13.1.8 Secondary control station (dual hatch ships only). Elevators serving the sequence level via a door shall be provided with a secondary control station with functionality in accordance with the 573-6723830 master control station. All control station elements shall be panel-mounted within a lockable (by separate padlock) enclosure. The secondary control station shall be arranged such that the operator can observe operation of elevator closures and loading/unloading operations at that level for the associated elevator.

3.13.1.9 Recessed control station. When specified (see 6.2.ll), elevators with flight deck hatches shall be provided with recessed control stations in close proximity to the elevator flight deck hatch. Recessed control station functionality shall be in accordance with 573-6723830 with STOW pushbutton capability but without call to flight deck capability (unstow). Recessed control stations shall be arranged such that the control station operator can observe elevator closure operation and loading/unloading operations at that level for the associated elevator.

3.13.1.10 Deck level control station. Deck level control stations are required at each level served (except where a master, secondary, or recessed type control station is 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 table VII. All control station elements shall be panel-mounted. If a deck control station serves the stow level with a trunk door, the control station shall be installed within a lockable (by separate padlock) enclosure, unless that control station is located in a locked space. Access to control stations shall not be blocked by opened doors or hatches. Deck level control stations shall be arranged so that the operator can observe operation of elevator closures and loading/unloading operations at that level for the associated elevator.

3.13.1.11 Power disconnect switch. Each elevator control system shall be provided with a power disconnect switch, type NQB-A250 in accordance with MIL-DTL-17361 or other Technical Authority-approved three-phase switch or relay, which shall interface with the power disconnect safety circuit (see 3.13.3.11). The power disconnect switch shall be provided with a separate enclosure, and shall be located in the machinery room adjacent to the machinery room access. A local ON/OFF control capability shall be provided to the power disconnect switch within the enclosure.

3.13.1.12 Diagnostic terminal. Where PLCs are used, a diagnostic terminal shall be provided for primary operator interface to select and display all elevator system status, configuration, and diagnostic information. The diagnostic terminal shall conform to the following:

a. Shall be located in the machinery room near the PLC enclosure. Operation of the diagnostic terminal shall not require opening or accessing the interior of the PLC enclosure.

b. Shall include a touchscreen human machine interface (HMI) that conforms to 3.13.3.17.

c. Shall allow an operator using the terminal to select and display all elevator usage data (see 3.25) in accordance with table X, elevator system status in accordance with table XI, diagnostic information in accordance with table XII, troubleshooting, fault indications, and corrective maintenance procedures.

d. Shall allow an operator using the terminal to display the current state of each limit switch, proximity switch, sensor, relay, and each PLC input and output function.

e. Shall employ anti-tamper technologies to prevent physical tampering or alteration.

f. Shall allow an operator using the terminal to display and adjust elevator system programmable parameters and check the valid syntax and semantics of inputs, such as character set, length, numerical range, and acceptable values. Password protection shall be incorporated to prevent unauthorized adjustment of programmable parameters.

g. Shall display elevator configuration data, including all elevator system project files currently loaded.

h. Shall be located in close proximity to the Machinery Room Control Station (see 3.13.1.5) with an unobstructed view of the hoist machinery.

i. Shall store a backup copy of the project file and parameter file in non-volatile memory.

j. Shall interface with the processor via an open architecture network communication protocol and be configured in accordance with DoDI 8551.01.

k. Shall automatically log out users after 15 minutes of inactivity.

l. Shall not utilize shared or group accounts, unless such accounts are required for operation or maintenance of the elevator control system.

m. The enclosure shall include an external Ethernet port with a lockable cover. This port shall allow selection and display of all elevator system status, diagnostic, and troubleshooting information via a portable computer utilizing the operating system software and communication protocols, as specified (see 6.2.ii). This port shall additionally allow adjustment of elevator system programmable parameters, upload and download of all elevator project files, and download of elevator usage data (see table X). This port shall be accessible without opening or accessing the interior of the diagnostic terminal enclosure. A hinged or removable cover shall be provided to protect the port when it is not in use.

3.13.2 Control system function. The control system shall function such 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 ±0.25 inch of the selected level when loaded or unloaded.

d. The platform is capable of being dispatched to any level from any level served by the elevator.

e. 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 or confirmation of the laser measured distance for that level.

f. When the platform is dispatched to an intermediate level, input from subsequent switches or laser distance measurement in the direction of travel beyond the destination shall cause the logic controller to bring the platform to a stop in case the switch(es) or laser positioning at the destination level fails to do so (see Appendix C).

g. The platform shall not be capable of switching from high speed to slow speed and back to high speed, without first stopping, per single dispatch of elevator platform.

3.13.3 Control system design requirements. The control system shall operate on 440-VAC, three-phase, 60-hertz, three-wire, ungrounded power complying with the steady state and transient characteristics and ranges in MIL-STD-1399-300-1. Step down transformers shall provide the control system with 115-VAC power 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 with MIL-PRF-15160 fuses.

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. The control system shall be designed to fail-safe such that failure of any electrical device, electrical connection, or network communication shall not result in damage to the load, or jeopardize the safety of personnel or result in uncontrolled movement of the equipment and load.

3.13.3.1.1 Dead-man feature. Where specified, dead-man operation of control system pushbuttons and rotary switches shall be incorporated to ensure positive operator control of machinery (see 6.7.2). When human input is discontinued, the switch or pushbutton shall return to its default state and the commanded motion shall stop.

3.13.3.1.2 Up overtravel (UOT). A UOT proximity switch shall be provided and shall conform to 3.13.3.14. The UOT proximity switch shall prevent powered platform travel above the upper terminal level (see 6.7.21) in the event of failure of any normal control system component to stop the elevator at the upper terminal level. The UOT proximity switch shall be actuated when the platform travels above the upper terminal level up stop deck level proximity switch by a separate vane from that used to actuate deck level slow and stop proximity switches. If the laser sensor fails to stop the elevator at the upper terminal level without faulting, the UOT proximity switch shall be actuated. When the platform is traveling upward in slow speed, actuation of the UOT proximity switch shall prevent the platform from striking the up positive stops. The UOT proximity switch shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2.k), if applicable. The SIR 115 and, if applicable, the PLC SIR circuits shall be interrupted by actuation of the UOT proximity switch. Jogging down in maintenance jog mode or emergency jog mode with the bypass switch in the UOT bypass position shall be the only powered means to move out of an UOT condition.

3.13.3.1.3 Up travel limit (UTL). Elevators having flush deck hatches shall be provided with a UTL proximity switch that conforms to 3.13.3.14. The UTL proximity switch shall prevent any part of the upward traveling platform, and any load or emergency MEDEVAC enclosure thereon, from striking a fully closed hatch. The UTL proximity switch shall actuate when the platform reaches a point just above the specified hatch sequence level (see 6.2.mm) by a vane separate from that used to actuate deck level slow and stop proximity switches. If the laser sensor fails to stop the elevator at the hatch sequence position without faulting, the UTL proximity switch shall be actuated. The UTL proximity switch shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2 k), if applicable. The SIR 115 and, if applicable, PLC SIR circuits shall be interrupted if the protected hatch is not secured in the fully open position, and the UTL proximity switch is actuated. Jogging down in maintenance jog mode or emergency jog mode with the bypass switch in the UTL bypass position shall be the only powered means to move out of an UTL condition.

3.13.3.1.4 Down travel limit (DTL). A DTL proximity switch conforming to 3.13.3.14 shall be provided for all elevators having an in-trunk hatch. The DTL proximity switch shall prevent the platform from striking an in-trunk hatch that is not fully open. The DTL proximity switch shall also prevent the platform from traveling into guide rail gaps when hinged guide rails are not secured in correct alignment with the corresponding fixed guide rails. The DTL proximity switch shall actuate when the platform reaches a point just below the hatch sequence level, as specified (see 6.2.mm). The DTL proximity switch shall be operated by a vane separate from that used to actuate deck level slow and stop proximity switches. If the laser sensor fails to stop the elevator at the hatch sequence position without faulting, the DTL proximity switch shall be actuated and shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2.k), if applicable. The SIR 115 and, if applicable, PLC SIR circuits shall be interrupted if the protected hatch is not secured in the fully open position or if the hinged guide rails are not secured in correct alignment with corresponding fixed guide rails, and the DTL proximity switch is actuated. Jogging up in maintenance jog mode or emergency jog mode, with the bypass switch in the DTL bypass position, shall be the only powered means to move out of a DTL condition.

3.13.3.1.5 Overspeed governor. The overspeed governor (see 3.6.3) shall be equipped with an overspeed governor proximity switch that conforms to 3.13.3.14. The overspeed governor proximity switch shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2.k), if applicable. The SIR 115 and, if applicable, PLC SIR circuits shall be interrupted when the overspeed governor actuates. Jogging up in maintenance jog mode with the bypass switch in the overspeed governor bypass position or emergency jog mode shall be the only powered means to move the elevator out of a tripped overspeed governor condition.

3.13.3.1.6 Overspeed governor slack rope. The overspeed governor shall be equipped with an overspeed governor slack rope (see 3.6.4) proximity switch that conforms to 3.13.3.14. The overspeed governor slack rope proximity switch shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2 k), if applicable. The SIR 115 and, if applicable, PLC SIR circuits shall be interrupted when the overspeed governor slack rope device actuates. Jogging up in maintenance jog or emergency jog mode with the bypass switch in the slack rope bypass position shall be the only powered means to move the elevator out of an overspeed governor slack rope condition.

3.13.3.1.7 Hoist slack rope. Each hoist slack rope device (see 3.6.5) shall be equipped with a hoist slack rope proximity switch that conforms to 3.13.3.14. The hoist slack rope proximity switch shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2.k), if applicable. The SIR 115 and, if applicable, the PLC SIR circuits shall be interrupted when the hoist slack rope device actuates. Jogging up in maintenance jog or emergency jog mode with the bypass switch in the slack rope bypass position shall be the only powered means to move the elevator out of a hoist slack rope condition.

3.13.3.1.8 Terminal level up high speed stop. A terminal level up high speed stop switch shall be provided and shall conform to 3.13.3.14. The terminal level up high speed stop switch shall actuate when the upward traveling platform travels just beyond the up slow switches or the laser sensor position at the upper terminal level. The switch shall prevent the platform from traveling at high speed into the positive stops. The terminal level up high speed stop switch shall be operated by a dedicated platform mounted high speed stop cam separate from the cams/vanes used for normal stopping. Terminal level up high speed stop switches shall provide input to the power disconnect safety circuit (see 3.13.3.11). When actuated by the platform traveling upward at high speed, the terminal level up high speed stop switch shall interrupt the closed-loop power disconnect circuit, thereby opening the power disconnect switch (see 3.13.1.11).

3.13.3.1.9 Terminal level down high speed stop. A terminal level down high speed stop switch shall be provided and shall conform to 3.13.3.14. The terminal level down high speed stop switch shall actuate when the downward traveling platform travels just beyond the down slow switches or the laser sensor position at the lower terminal level (see 6.7.10). The switch shall prevent the platform from traveling at high speed into the buffer springs due to a control system malfunction. The terminal level down high speed stop switch shall be operated by a dedicated platform mounted high speed stop cam separate from the cams/vanes used for normal stopping. Terminal level down high speed stop switches shall provide input to the power disconnect circuit (see 3.13.3.11). When actuated by the platform traveling downward at high speed, the terminal level down high speed stop switch shall interrupt the closed-loop power disconnect circuit, thereby opening the power disconnect switch (see 3.13.1.11).

3.13.3.1.10 Hatch sequence level up high speed stop. A hatch sequence level up high speed stop switch shall be provided for all elevators having a flush deck hatch and shall conform to 3.13.3.14. The hatch sequence level up high speed stop switch shall actuate when the platform travels beyond the up slow switches or the laser sensor position of the hatch sequence level, as specified (see 6.2 mm). The hatch sequence level up high speed stop switch shall prevent the platform and any load thereon from striking a fully closed flush deck hatch during high speed operation. The hatch sequence level up high speed stop switch shall be operated by a dedicated platform mounted high speed stop cam separate from the cams/vanes used for normal stopping. Hatch sequence level up high speed stop switches shall provide input to the power disconnect circuit (see 3.13.3.11). When the flush deck hatch is not fully open and the platform is traveling upward at high speed, actuation of the hatch sequence level up high speed stop switch shall interrupt the closed-loop power disconnect circuit, thereby opening the power disconnect switch (see 3.13.1.11).

3.13.3.1.11 Hatch sequence level down high speed stop. A hatch sequence level down high speed stop switch conforming to 3.13.3.14 shall be provided for all elevators having an in-trunk hatch. The hatch sequence level down high speed stop switch shall actuate when the platform travels beyond the down slow switches or the laser sensor position of the hatch sequence level, as specified (see 6.2.mm). The hatch sequence level down high speed stop switch shall prevent the platform from striking an in-trunk hatch that is not fully open due to control system malfunction during high speed operation and shall prevent the platform from traveling into guide rail gaps when hinged guide rails are not secured in correct alignment with the platform during high speed operation. The hatch sequence level down high speed stop switch shall be operated by a dedicated platform mounted high speed stop cam separate from the cams/vanes used for normal stopping. The hatch sequence level down high speed stop switch shall provide input to the power disconnect circuit (see 3.13.3.11). When the in-trunk hatch is not fully open or hinged guide rails are not secured in correct alignment and the platform is traveling downward at high speed, actuation of the sequence level down high speed stop switch shall interrupt the closed-loop power disconnect circuit, thereby opening the power disconnect switch (see 3.13.1.11).

3.13.3.1.12 Door interlocks. Elevator trunk doors shall be electrically interlocked. Electric interlocks for powered doors shall be accomplished by electrically interlocking the powered operation of the door and any associated powered latches, ramps, and dogs. Interlocks for manually operated doors shall be accomplished by electrically operated mechanical securing devices. Definitions of a door being fully open or fully closed are provided in 6.7.3. Door interlocks shall comply with the following requirements:

a. Each door shall be interlocked to prevent the door from being opened by the normal operating means unless the platform is stopped at the corresponding deck level.

b. Each door shall be interlocked to prevent elevator platform travel (dispatch or jog) unless all doors are dogged. The door dogged interlock shall provide input to the SIR 115 circuit (see 3.13.3.10) and shall de-energize the SIR 115 circuit when not dogged. Likewise, the door dogged interlock shall provide input to the PLC SIR circuit (see 3.13.1.3.2 k), if applicable, and interrupt the PLC SIR when not dogged.

c. When more than one door is provided, each door shall be interlocked so that only one door can be opened at any time. When specified (see 6.2.nn), this requirement may be waived for doors at the same level that open to the same compartment.

d. Each door shall be interlocked to prevent opening the door when a flush deck hatch is not fully closed.

e. Each door shall be interlocked to prevent the door from being opened while any hatch is moving.

f. Powered operation of doors, door dogging, door ramps, and door latches shall be interlocked to ensure proper sequencing.

g. Door interlock switches shall conform to 3.13.3.14.

h. If any door is not fully closed, no other deck level may open a door.

i. Opening of any powered door (including powered latching/unlatching) shall not be possible unless the RUN/STOP switch at the associated door control station is in the STOP position.

j. All doors shall be electrically interlocked to prevent electrical operation when the STOW switch is actuated at the master control station.

3.13.3.1.13 Hatch interlocks. Hatch electrical interlocks shall be provided on all elevators having flush deck or in-trunk hatches. Hatch interlocks shall:

a. Prevent operation of flush deck hatches when the platform is above the hatch sequence level.

b. Prevent platform travel above the hatch sequence level when the flush deck hatch is not secured in the fully open position.

c. On elevators having in-trunk hatches, prevent operation of in-trunk hatches when the platform is below the hatch sequence level.

d. On elevators having in-trunk hatches, prevent platform from traveling below the hatch sequence level if the in-trunk hatch is not secured in the fully open position.

e. On elevators with dual hatches, prevent one hatch from opening when the other hatch is not fully closed.

f. Prevent any hatch operation that will foul the hoist ropes, guide rails, ramps, or platform.

g. Prevent operation of any hatch when any door is not fully closed.

h. Powered operation of hatches, hatch dogging, hatch ramps, hinged rails, and hatch latches shall be interlocked to ensure proper sequencing.

i. Hatch interlock switches shall conform to 3.13.3.14.

3.13.3.1.14 Trunk interference interlocks. Trunk interference interlock switches shall be provided to prevent platform movement when ramps, booms, monorails, emergency handling equipment, or other permanently installed devices are positioned in the way of platform travel. Trunk interference interlocks shall provide input to the SIR 115 circuit (see 3.13.3.10). Trunk interference interlocks shall de-energize the SIR 115 circuit and the PLC SIR circuit (see 3.13.1.3.2 k), if applicable. The SIR 115 and, if applicable, PLC SIR circuits shall be interrupted if the trunk interference interlocks are actuated. Trunk interference interlock switches shall conform to 3.13.3.14.

3.13.3.1.15 Emergency stop (E-STOP) pushbuttons. E-STOP pushbuttons shall be provided at all control stations with unobstructed access. An E-STOP pushbutton shall also be provided at each flush deck hatch such that it is readily accessible to personnel loading/unloading the elevator at the hatch level when the hatch is fully open. Additional E-STOP pushbuttons shall be installed in any portion of the elevator machinery room with rotating or moving machinery not visible from the machinery room control station. E-STOP pushbuttons shall be in accordance with table IX and shall be watertight, non-latching, mushroom head, or palm-operated pushbuttons utilizing normally closed contacts. E-STOP pushbuttons shall provide input to the power disconnect circuit (see 3.13.3.11). E-STOP pushbuttons shall be colored red. When actuated, the button shall interrupt the closed-loop power disconnect circuit, thereby opening the power disconnect switch (see 3.13.1.11).

3.13.3.1.16 Emergency stow (E-STOW) pushbuttons. All elevators with flush deck hatches shall be provided with an E-STOW feature to allow an operator to fully close the flush hatch from the local control station without the operator remaining on station. An E-STOW pushbutton in accordance with table IX 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 the hatch sequence level (see 6.7.7) or parking level (see 6.7.12) and sequence the hatch to fully close, even if RUN/STOP switches are in the STOP position. E-STOW shall override door interlocks but shall not override the hoisting or overspeed governor slack rope devices. The E-stow function shall not operate when the JOG selector switch is in the DECK JOG or MAINTENANCE JOG position.

3.13.3.1.17 STOW pushbuttons. All elevators with dual hatches shall be provided with a STOW pushbutton to allow an operator to dispatch the platform to the sequence level, as specified (see 6.2.oo), between the hatches, fully close the open hatch, and secure all powered doors from being electrically opened. A STOW pushbutton, either virtual (see 3.13.3.17) or actual in accordance with table IX, shall be provided at master and secondary control stations. For single hatch elevators, depressing the STOW pushbutton shall dispatch the platform to a determined parking level, as specified (see 6.2.oo), fully close the open hatch and, upon stopping at that stow level, all doors shall be electrically locked from opening. A STOW pushbutton, either virtual (see 3.13.3.17) or actual in accordance with table IX, shall be provided at the master control station. On elevators without hatches, depressing the STOW pushbutton shall dispatch the platform to a determined parking level, as specified (see 6.2.oo), and upon stopping at that stow level, all doors shall be electrically locked from opening. A STOW pushbutton, either virtual (see 3.13.3.17) or actual in accordance with table IX, shall be provided at the master control station.

3.13.3.1.18 UNSTOW pushbuttons. All elevators with dual hatches shall be provided with an UNSTOW feature, either virtual (see 3.13.3.17) or actual in accordance with table IX, on the secondary control station to allow an operator to call the platform to a secondary control level and allow powered doors to be electrically opened under normal operation. For single hatch elevators and elevators without a hatch, depressing the UNSTOW pushbutton, either virtual (see 3.13.3.17) or actual in accordance with table IX, at the master control station shall call the platform to the master control level and allow powered doors to be electrically opened under normal operation.

3.13.3.2 RUN/STOP switch. A two-position RUN/STOP selector switch in accordance with table IX shall be provided at each control station and shall provide input to the SIR 115 circuit (see 3.13.3.10) and to the PLC SIR circuit (see 3.13.1.3.2 k), if applicable. The switch shall be detented in both the RUN and STOP positions. When any RUN/STOP switch is in the STOP position, it shall de-energize the SIR 115 circuit, as well as the PLC SIR circuit, if applicable, and prevent platform or hatch motion, except in the E-stow mode. Doors shall be capable of being fully closed in either the RUN or STOP position. However, it shall not be possible to open any powered door (including powered latching/unlatching) unless the RUN/STOP switch at the associated control station is in the STOP position. Any hatch or platform motion shall be terminated (except if E-STOW is commanded) if the RUN/STOP selector switch is placed in the STOP position. Any operation interrupted by the positioning of a RUN/STOP switch to STOP shall not automatically resume when the RUN/STOP switch is returned to the RUN position.

3.13.3.2.1 RUN/STOP/CANCEL E-STOW switch. A RUN/STOP/CANCEL E-STOW selector switch in accordance with table IX shall be provided in lieu of a RUN/STOP switch at each control station having an E-STOW switch. The RUN/STOP/CANCEL E-STOW switch shall comply with the RUN/STOP switch requirements specified in 3.13.3.2, except as follows:

a. The switch shall be a three-position selector switch detented in the RUN and STOP positions.

b. When positioned in the CANCEL E-STOW position, the switch shall be spring returned to the STOP position when released by the operator.

c. When positioned to CANCEL E-STOW during an emergency stow operation, stow operation shall stop.

d. If the E-STOW process is interrupted, the E-STOW pushbutton must be actuated again to restart operation.

3.13.3.3 Door control. All elevator trunk powered doors shall be manually controlled by a three-position spring centered rotary switch either virtual (see 3.13.3.17) or actual in accordance with table IX, and provided at the control station serving that door. The switch positions shall be OPEN/STOP/CLOSE with spring return to STOP position.

3.13.3.4 Flush deck hatch control.

3.13.3.4.1 Automatic flush deck hatch control. Elevator flush deck hatches shall operate in sequence with elevator platform movement in accordance with 573-6723830 and 573-6723831. With the platform in the stow or hatch sequence position as specified (see 6.2 mm), the in-trunk hatch (if applicable) fully closed, the flush hatch fully closed, and a dispatch command to the flush deck level has been initiated, the HATCH CLEAR request indicator shall illuminate. If the HATCH CLEAR pushbutton is depressed within 30 seconds of the request, the flush hatch shall initiate opening sequence. If the HATCH CLEAR pushbutton is not depressed within 30 seconds of the HATCH CLEAR request indication, the HATCH CLEAR request shall be automatically cancelled. When in the fully open position, flush deck hatches shall automatically and fully close after the platform has been dispatched from the flush deck hatch level and has reached a position where/when it is safe to fully close the flush hatch. It shall not be possible for a flush deck hatch to fully close when any part of the platform, load, or Emergency MEDEVAC enclosure is in the way of the hatch closure position.

3.13.3.4.2 Non-automatic flush deck hatch control. With the platform in the stow or hatch sequence position as specified (see 6.2 mm), the HATCH RAISE and HATCH LOWER switch shall operate the hatch in the open and closed direction only when the HATCH CLEAR switch is continuously depressed. The HATCH CLEAR switch shall allow an operator to monitor the hatch through the full range of motion.

3.13.3.5 In-trunk hatch control. All elevator in-trunk hatches shall be automatically operated in sequence with elevator platform position and movement in accordance with 573-6723830. When fully open, in-trunk hatches shall automatically fully close when the platform has reached the hatch sequence level and the destination level is above sequence level. When fully closed, in-trunk hatches in the way of platform travel shall automatically fully open when the platform has reached the hatch sequence level and the destination level is below sequence level. It shall not be possible for an in-trunk hatch to fully close or open when any part of the platform, hoist ropes, or guide rails are in the way of the hatch.

3.13.3.6 Bypass switch. The bypass switch shall be a three-position rotary switch in accordance with table IX. The UOT-UTL/NORMAL/SR-DTL selector switch shall be spring returned to the NORMAL (center) position. The bypass switch shall prohibit dispatch operation while the BYPASS selector switch is in either of the two bypass positions. The bypass switch shall operate as follows:

a. In the event of a UOT condition, positioning the bypass switch to the up overtravel (UOT-UTL) position shall enable the platform to be jogged down in maintenance jog mode to correct the condition.

b. In the event of a UTL condition, positioning the bypass switch to the UTL position shall enable the platform to be jogged down in maintenance jog mode to correct the condition.

c. In the event of a DTL, hoist slack rope, overspeed governor trip, or overspeed governor slack rope condition, positioning the bypass switch to the slack rope (SR-DTL) bypass position shall enable the platform to be jogged up in maintenance jog mode to correct the condition.

3.13.3.7 Maintenance jog and deck jog controls. The maintenance and deck jog controls shall be either virtual (see 3.13.3.17) or actual in accordance with table IX and shall consist of a three-position, detented, DECK/NORMAL/MAINTENANCE JOG selector switch and UP and DOWN JOG pushbutton switches. Jogging shall be possible only in slow speed. Jogging shall only be possible when the JOG selector switch is in either the DECK or MAINTENANCE JOG position. The JOG selector switch shall prohibit dispatch, stow, or emergency stow operation while the JOG selector switch is in either of the jog positions. The jog modes enabled by the JOG selector switch shall be as follows:

a. When positioned to DECK JOG, the jog selector shall enable movement from off deck level to the next level when the appropriate UP or DOWN JOG pushbutton is depressed. When operated in DECK JOG mode, the platform shall stop when it reaches any deck level, or when the UP or DOWN JOG pushbutton is released, or when the JOG selector switch is released to NORMAL position.

b. When positioned to MAINTENANCE JOG, the jog selector shall enable movement of the platform anywhere between the UTL switch and the DTL switch for elevators with dual hatches closed when the UP or DOWN JOG pushbutton is depressed. For elevators with a closed flush hatch (not dual hatches), the jog selector shall enable movement of the platform anywhere between the UTL and the lower terminal level stop switch when the UP or DOWN JOG pushbutton is depressed. For elevators with a closed in-trunk hatch (not dual hatches), the jog selector shall enable movement of the platform anywhere between the upper terminal stop switch and the DTL switch when the UP or DOWN JOG pushbutton is depressed. For elevators without hatches or dual hatches with both hatches open, the jog selector shall enable platform movement anywhere between the terminal level stop switches when the UP or DOWN JOG pushbutton is depressed. When operated in MAINTENANCE jog mode, the platform shall stop when it reaches one of these terminal switches described, when the JOG pushbutton is released, or when the JOG selector switch is released to the NORMAL position.

3.13.3.8 Emergency run. An EMERGENCY RUN pushbutton capability shall be provided in the machinery room and shall be a dead-man type pushbutton in accordance with table IX. When depressed and held, EMERGENCY RUN shall bypass the motor overload relay of the SIR 115 circuit (see 3.13.3.10) and the PLC SIR circuit (see 3.13.1.3.2 k), if applicable, enabling the platform to be jogged or dispatched while the motor overload relay or motor overtemperature switch is tripped.

3.13.3.9 Emergency jog controls. Elevators utilizing a PLC shall be provided with emergency jog controls. A NORMAL/EMERGENCY JOG switch in accordance with table IX shall bypass the PLC SIR relay contacts of the SIR 115 circuit (see 3.13.3.10), enabling the platform to be jogged up or down in the event of a PLC failure. An EMERGENCY JOG ENABLED indicator light shall illuminate when the NORMAL/EMERGENCY JOG switch is in the EMERGENCY JOG position that shall be located at the machinery room control station.

3.13.3.10 Safety interlock relay (SIR) 115 circuit. An SIR circuit shall be provided and all of its components shall operate on 115 VAC; the circuit shall be labeled “SIR 115”. The SIR 115 circuit shall be a hardwired relay-based circuit and shall not depend on software or network communication to perform its functions. The SIR 115 relay (see 3.13.3.16) shall remain energized for elevator operation. When the SIR 115 de-energizes, it shall de-energize the hoist motor (or variable speed hoist motor bridge) and brake and interrupt all dispatch and jog commands, thereby stopping the platform and preventing further platform dispatch or jog operation. Any command or operation interrupted by the de-energizing of the SIR 115 shall not automatically resume when the SIR 115 is re-energized. The SIR 115 circuit shall be in accordance with 573-6723830, 573-6723831, or 803-8436628, as applicable. Solid-state relays may be used in conjunction with electromechanical relays as specified in 3.13.3.16 to accomplish SIR 115 circuit functions. The SIR 115 shall be de-energized by the following:

a. Actuation of the UOT proximity switch as specified in 3.13.3.1.2.
b. Actuation of the UTL proximity switch as specified in 3.13.3.1.3.
c. Actuation of the DTL proximity switch as specified in 3.13.3.1.4.
d. Actuation of the overspeed governor proximity switch as specified in 3.13.3.1.5.
e. Actuation of the overspeed governor slack rope proximity switch as specified in 3.13.3.1.6.
f. Actuation of any hoist slack rope proximity switch as specified in 3.13.3.1.7.
g. Actuation of a hoist motor overload relay as specified in 3.13.1.1.
h. When any trunk door is not fully closed as specified in 3.13.3.1.12.

i. Placing of any RUN/STOP or RUN/STOP/CANCEL E-STOW switch in the STOP position as specified in 3.13.3.2 and 3.13.3.2.1.

j. Actuation of any trunk interference proximity switch as specified in 3.13.3.1.14.

k. When the PLC Ready relay is de-energized as specified in 3.13.1.3.2.

3.13.3.11 Power disconnect safety circuit. The power disconnect safety circuit shall be a dedicated, hardwired, fused 115-VAC closed-loop circuit that is generated from the input power (440 VAC) to the power disconnect device (see 3.13.1.11). Interruption of the 115-VAC closed-loop circuit shall cause the power disconnect switch to open and remove all 440-VAC power to the elevator system. The power disconnect safety circuit shall remain fully functional in the event of failure of any electronics, software, or network communications forming part of the elevator system. The power disconnect switch shall be de-energized by the following:

a. Actuation of any E-STOP pushbutton (see 3.13.3.1.15).

b. Actuation of the terminal level up high speed stop switch while the platform is traveling upward at high speed (see 3.13.3.1.8).

c. Actuation of the terminal level down high speed stop switch while the platform is traveling downward at high speed (see 3.13.3.1.9).

d. Actuation of the hatch sequence level up high speed stop switch while the platform is traveling upward at high speed and the flush deck hatch is not fully open (see 3.13.3.1.10).

e. Actuation of the hatch sequence level down high speed stop switch while the platform is traveling downward at high speed and the in-trunk hatch is not fully open (see 3.13.3.1.11).

f. Manual deactivation of the power disconnect switch at the local control (see 3.13.3.1.11).

3.13.3.12 Deck level slow and stop switches. Unless a laser position sensor (see 3.13.3.15) is utilized, two deck level proximity switches shall be provided at each deck level where the elevator is required to slow and stop. At intermediate decks, the down slow switch shall also function as the up stop switch, and the down stop switch shall also function as the up slow switch. Dispatch of the elevator shall not be possible unless both deck level switches for the dispatching level are actuated. When the dispatched platform approaches the selected destination deck level in high speed, the destination deck level slow switch shall actuate and the platform shall decelerate from high speed to slow speed before the platform reaches the destination deck level stop switch. As the platform approaches the destination deck level in slow speed, the deck level stop switch shall actuate and the platform shall stop at the destination deck level. Deck level slow and stop proximity switches shall conform to 3.13.3.14. The platform controller shall detect improper switch actuation sequence and respond as follows:

a. In the event that the platform fails to actuate the destination deck level stop switch, the platform shall continue in slow speed and stop when the next switch in sequence is actuated.

b. In the event that the platform fails to actuate the destination deck level slow switch, the platform shall shift to slow speed when the next switch is actuated and stop on the subsequent switch.

c. In the event that the platform travels in the wrong direction, the platform shall stop immediately.

3.13.3.13 Duplicate slow switches. Unless a laser position sensor (see 3.13.3.15) is utilized, the duplicate slow switches shall control functions the same as the slow switches and shall be operated by a separate vane from that used to actuate deck level slow and stop proximity switches. Duplicate slow proximity switches shall conform to 3.13.3.14.

a. At the upper terminal level, a duplicate up slow deck level proximity switch shall be provided. At the lower terminal level, a duplicate down slow deck level proximity switch shall be provided.

b. At hatch sequence levels, duplicate up slow and duplicate down slow sequence level proximity switches shall be provided. For PLC based systems, the functions of the UTL and duplicate sequence level up slow switch may be combined. Also, for PLC based systems, the functions of the DTL and duplicate sequence level down slow switch may be combined.

3.13.3.14 Proximity switches and limit switches. Proximity switches and limit switches shall be as specified in table VIII. This requirement does not apply to switches internal to or imbedded in devices, such as motor overtemperature switches or manually operated switches. All trunk mounted platform position sensors shall be provided with three-axis adjustability. Once adjusted, the sensors shall be locked in position without disturbance by shock or vibration.

3.13.3.15 Laser sensor. A laser sensor may be used to sense elevator platform position for elevators with control systems that use a PLC; the laser sensor would be used in lieu of deck level slow and stop switches (see 3.13.3.12) and duplicate slow switches (see 3.13.3.13). The laser sensor shall meet the requirements of ANSI Z136.1 for a class 2 device. The laser shall have a range of 0 to 328 feet (0 to 100 meters) and a resolution of 0.04 inch (1 millimeter). To protect personnel, the laser diode shall turn off when either the RUN/STOP switch is placed in STOP or any door is not fully closed. The laser diode shall energize within 300 milliseconds when doors are fully closed and the RUN/STOP switches are in the RUN position. The laser sensor shall establish platform position within 10 milliseconds. Initiation of E-STOW shall energize the laser diode in the same manner and under the same conditions as specified in 3.13.3.1.16. Loss of signal from the laser sensor shall immediately cause the platform to stop. The relative signal strength shall be displayed at the diagnostic terminal. A maintenance warning shall be provided at the diagnostic terminal when the relative signal strength falls below 20 percent and the PLC shall de-energize the PLC Ready relay (see 3.13.1.3.2.j) when the relative signal strength falls below 12 percent. The laser shall have the capability to be aligned after it is mounted. The laser shall be mounted to minimize possible eye contact with the laser beam. The laser shall be a continuous wave design.

TABLE VIII. Proximity and limit switch requirements.

Application	Switch type and specification	Switch voltage/size/contacts	Contacts to utilize	Additional requirements
Deck level slow and stop switches	Proximity switch in accordance with MIL-PRF-24711	24 VDC, 1.5-inch with normally open AND normally closed contacts	Normally open	3.13.3.12
Duplicate slow switch	Proximity switch in accordance with MIL-PRF-24711	24 VDC, 1.5-inch with normally open AND normally closed contacts	Normally closed	3.13.3.13
Overtravel and travel limit proximity switches	Proximity switch in accordance with MIL-PRF-24711	115 VAC, 1.5-inch with normally closed contacts	Normally closed	3.13.3.1.2, 3.13.3.1.3, and 3.13.3.1.4
Overspeed governor, governor slack rope, and hoist slack rope device proximity switches	Proximity switch in accordance with MIL-PRF-24711	115 VAC, 0.5-inch with normally open contacts	Normally open	3.13.3.1.5, 3.13.3.1.6, and 3.13.3.1.7
Door interlock, hatch interlock proximity switches	Proximity switch in accordance with MIL-PRF-24711	115 VAC, 0.5-inch OR 1.0-inch with normally open contacts	Normally open	3.13.3.1.12 and 3.13.3.1.13
Trunk interference interlock proximity switches	Proximity switch in accordance with MIL-PRF-24711	115 VAC, 0.5-inch with normally open contacts	Normally open	3.13.3.1.14
All other interlock switches	Proximity switch in accordance with MIL-PRF-24711	115 VAC, 0.5-inch with normally open OR normally closed contacts	Normally open OR normally closed	--
Terminal level high speed stop limit switches and sequence level high speed stop limit switches	Electromechanical limit switch in accordance with MIL-DTL-2212	115 VAC, single-phase with normally open AND normally closed contacts	Normally closed	Watertight with counter-balanced roller arm and 1.5-inch diameter heavy duty roller. See 3.13.3.1.8, 3.13.3.1.9, 3.13.3.1.10, and 3.13.3.1.11
Emergency stop	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally closed contacts	Normally closed	3.13.3.1.15
Emergency stow	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally open contacts	Normally open	3.13.3.1.16
Stow	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally open contacts	Normally open	3.13.3.1.17

TABLE IX. Manual switch requirements.

Application	Switch type and specification	Switch voltage/size/contacts	Contacts to utilize	Additional requirements
Unstow	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally open contacts	Normally open	3.13.3.1.18
Run/stop	Two-position, detented rotary switch in accordance with MIL-DTL-2212	115 VAC double pole, double throw	Both	3.13.3.2
Run/stop/cancel emergency stow	Three-position, detented rotary switch in accordance with MIL-DTL-2212	115 VAC double pole, double throw	Both	3.13.3.2.1
Door control	Three-position, spring center rotary switch in accordance with MIL-DTL-2212	115 VAC double pole, double throw	Both	3.13.3.3
Bypass	Three-position, spring center rotary switch in accordance with MIL-DTL-6807	115 VAC double pole, multiple throw	Both	3.13.3.6
Hatch clear	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally open contacts	Normally open	3.13.3.4
Deck jog/normal/maint. jog	Three-position, detented rotary switch in accordance with MIL-DTL-18396	115 VAC double pole, multiple throw	Both	3.13.3.7
Emergency run	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally open contacts	Normally open	3.13.3.8
Normal/emergency jog	Two-position, detented rotary switch in accordance with MIL-DTL-2212	115 VAC double pole, double throw	Both	3.13.3.9
High speed test switch	Two-position, spring return rotary switch in accordance with MIL-DTL-2212	115 VAC double pole, double throw	Closed	3.13.3.18
Drift jog	Pushbutton momentary switch in accordance with MIL-DTL-2212	115 VAC with normally open contacts	Normally open	3.13.3.19
Hatch raise/lower	Three-position, spring center rotary switch in accordance with MIL-DTL-6807	115 VAC double pole, multiple throw	Both	3.13.3.4.2

3.13.3.16 Relays. Solid-state relays in accordance with MIL-PRF-28750 shall be used in lieu of or in conjunction with electromechanical relays in accordance with MIL-R-19523 wherever practicable. Where electromechanical contactors or relays are used, their contacts shall not change states when subjected to the shock requirements (see 3.3.25). All electromechanical and solid-state relays shall be derated as follows:

Parameter	Max. percent of the related value
Contact current (continuous)	75 – Capacitive load 75 – 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 factor of mounting)
Maximum derated ambient temperature	Limited to 149 °F when rated at 185 °F 212 °F when rated at 257 °F

3.13.3.17 Touchscreen HMI. Elevators utilizing PLC(s) shall utilize a touchscreen type HMI at the machinery room diagnostic terminal (see 3.13.1.12). Elevators utilizing PLC(s) may also use touchscreen HMIs in lieu of control stations with the same functionality as specified in 3.13.1.5, 3.13.1.6, 3.13.1.7, 3.13.1.8, and 3.13.1.10. The functionality of the HMI for the machinery room may be combined as specified in 3.13.1.5 and 3.13.1.12. HMIs shall meet the following requirements:

a. Shall be a flat panel design utilizing an active matrix thin-film-transistor liquid-crystal, anti-glare, color visual display.

b. Shall comply with the human engineering requirements of 3.3.37 when installed and operated in its intended location.

c. Shall have a color visual display measuring not less than 8 inches diagonal in length and having a display resolution of not less than 640 by 480 pixels.

d. The visual display shall have a replaceable backlight with user adjustable brightness. When used in locations other than the elevator machinery room, the visual display shall incorporate brightness controls, anti-glare features, and display color schemes that enable the screen to be read and operated when the display is in direct sunlight and darken-ship conditions.

e. Shall be capable of displaying graphical user interface (GUI) displays such as pushbuttons, selector switches, screen selectors, numeric keypads, diagnostic indicators, message displays, bar graphs, ASCII displays, and list indicators.

f. Shall have a life of at least 40,000 hours.

g. Shall operate from either 24-VDC or 115-VAC power.

h. Shall contain non-volatile flash memory for the storage of the HMI program.

i. Unless otherwise specified (see 6.2.pp), shall interface with the elevator PLC via an open architecture network communication protocol.

j. Shall be provided with a hinged or removable cover to prevent inadvertent display screen contact by personnel or objects. The cover shall not prevent personnel from reading the display screen when the cover is positioned to protect the screen. The cover shall not be used to enable the HMI to comply with MIL-STD-461.

k. Shall not be used to accomplish the following functions:

(1) E-STOP pushbutton

(2) RUN/STOP selector switch

(3) RUN/STOP/CANCEL E-STOW selector switch

(4) BYPASS selector switch

(5) EMERGENCY JOG pushbuttons

(6) EMERGENCY RUN pushbutton

(7) EMERGENCY JOG ENABLED indicator light

(8) Power disconnect safety circuit test switch

(9) POWER DISCONNECT POWER AVAILABLE indicator light

(10) POWER DISCONNECT HIGH SPEED STOP indicator light

l. Where HMIs are used in lieu of electromechanical selector or pushbutton switches, the HMI shall emulate the detent, spring return, and dead-man characteristics specified for those control functions. The operator must touch the appropriate touch screen control icon to activate the desired event. When the operator discontinues contact with the touch screen control, the dead-man or return-to-center feature specified for that control shall activate.

m. All touchscreen HMIs shall display the following information (see tables XI and XII):

(1) Current elevator platform deck level location

(2) Current state of each SIR 115 circuit input

(3) Current state of each PLC SIR circuit bit

(4) Current state of each switch and relay

(5) Current state of PLC Ready bit

(6) Current elevator system fault status

(7) The operation command currently being executed (e.g., dispatch from main deck to fourth deck in progress)

(8) The most recent operation command executed (e.g., dispatch from main deck to fourth deck in progress)

n. Each HMI shall incorporate self-diagnostics. HMI fault status and diagnostic information shall be accessible through the HMI display.

o. Each HMI shall incorporate identification checks that shall prevent operation of the HMI using an incompatible program file. In the event a program file does not match the HMI configuration, the program file shall not be executed at startup and a fault message shall be accessible through the HMI display.

p. Shall have a blackened screen saver that is displayed when the HMI is not in use. The screen saver shall de-activate when operator input to the HMI occurs. The screen saver shall become active when 5 minutes have elapsed since the last operator input to the HMI.

q. Shall have a reset button that reboots the HMI when depressed.

3.13.3.18 High speed stop test switch. A high speed stop test switch shall be provided to simulate a high speed condition while jogging into either of the terminal level high speed stop switches (see 3.13.3.1.8 or 3.13.3.1.9) or the hatch sequence high speed stop switches (see 3.13.3.1.10 or 3.13.3.1.11) to demonstrate operation of the high speed stop circuit switches. With the high speed stop test switch engaged and while jogging into any of the high speed stop switches, the high speed stop circuit shall provide input to the power disconnect safety circuit (see 3.13.3.11) and cause the power disconnect switch to de-energize.

3.13.3.19 Drift jog. A drift jog capability, as specified (see 6.2.qq), shall allow the operator to level the platform after loading or unloading the platform. The RUN/STOP switch shall be in the RUN position to enable the drift jog circuit. Drift jog shall be enabled if the door is either open or fully closed. The control system shall identify the direction to move the platform when the DRIFT JOG pushbutton is depressed. Drift jog shall not be operable with the control system in bypass mode (see 3.13.3.6).

3.14 Solenoids. Solenoids shall be rated for continuous energized duty and be of a design that can operate satisfactorily during prolonged periods of inrush current caused by slow solenoid movement. Solenoids shall be encapsulated and have class H insulation. Solenoids shall be provided with individual fuses for their protection.

3.15 Voice communications. Elevators shall be equipped with sound-powered voice communication stations at each control station immediately adjacent to 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 to the motor controller and another communication station is required adjacent to the platform controller. Voice communication stations shall incorporate headsets and headset jacks. Voice communication stations shall provide operators with intelligible voice communication in the presence of ambient noise levels, corresponding elevator system operation, and elevator loading and unloading operations.

3.15.1 Emergency MEDEVAC voice communications. Elevators specified to be equipped with an Emergency MEDEVAC enclosure (see 3.5.3.8 and 6.2.ee) shall have provisions to allow for voice communication between personnel on the platform and personnel manning the elevator control station using hand-held wireless communication devices, regardless of elevator platform location and trunk closure condition (see 6.2.rr).

3.16 Trunk powered closure system. Unless otherwise specified (see 6.2.ss), trunk powered closure systems shall conform to 3.16.1 through 3.16.1.3. The elevator trunk powered closure system shall consist of machinery and controls as necessary for operation of powered elevator trunk doors, hatches, associated latches, dogging systems, ramps, and hinged guide rails. When specified (see 6.2.ss), the trunk closure system shall operate all powered trunk closures in accordance with 3.3.35, as applicable in moderate sea state. The trunk powered closure system shall allow for emergency operation of powered closures as specified in 3.3.35.5.

3.16.1 Hydraulic closure system. The elevator hydraulic closure system shall consist of a hydraulic power unit, actuators, and control valves as necessary to operate all hydraulically powered elevator trunk closures.

3.16.1.1 Hydraulic power unit. Hydraulic power units for elevator hydraulic closure systems shall be in accordance with 803-5959256.

3.16.1.2 Hydraulic closure circuits. Door hydraulic circuits shall be in accordance with 803-5959253, 803-5959255, 803-5959256, or 803-5959257. Hatch hydraulic circuits shall be in accordance with 803-5959252 or 803-5959259.

3.16.1.3 Solenoid operated valves. Solenoid operated valves shall be of a type that can be manually operated for test purposes and emergency operation. Valves shall be located outside of the trunk where they are easily accessible for service.

3.16.2 Electric closure system. A closure system utilizing electric actuators with drives or other control equipment to operate powered elevator trunk closures shall be approved by the Technical Authority.

3.17 Hatch stanchions and lifelines. Portable hatch stanchions with flush deck sockets and chain lifelines shall be provided around all elevator trunk flush deck hatch openings that are accessible to personnel when the hatch is not fully closed. Unless otherwise specified (see 6.2.tt), portable hatch stanchions, deck sockets, and chain lifeline assemblies shall be in accordance with 804-5184155. Deck socket design may be modified to suit applicable deck thickness and strength requirements. Stanchion spacing shall not exceed 72 inches. Sag in chain lifelines shall not exceed 0.75 inch per foot of length. The top course of chain lifelines shall be not less than 36 inches above the deck when measured at the lowest point of the chain. Chain lifelines shall have snap hooks on both ends. Stowage boxes for stowage of the portable stanchions and chain lifelines shall be provided at a location convenient to the hatch.

3.18 Lighting. Unless otherwise approved by the Technical Authority, all lighting fixtures shall be either fluorescent or Solid State Lighting (SSL), and all fixtures shall be in accordance with MIL-DTL-16377.

3.18.1 Trunk lighting. Lighting intensity shall average not less than 7 foot-candles when measured at 30 inches above the periphery of elevator platforms, at each level where the platform can be loaded, unloaded, or boarded by personnel. Elevators requiring darken ship condition (see 6.2.uu) shall be provided with red and white light fixtures and double throw switch controls.

3.18.2 Machinery room lighting. Lighting in elevator machinery spaces shall average not less than 10 foot-candles.

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

a. Surfaces shall receive a coating system as specified in NAVSEA Standard Item 009-32. Component finish coats shall be haze gray, except components in elevator trunks, which shall be white or, at weather deck openings where darken ship conditions (see 6.2.uu) require, black.

b. Handrails affixed to the moving platform shall be painted yellow. Guards around rotating machinery shall be painted red.

c. Touch up of damaged paint shall be as specified in 3.19.a.

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-SP 10.

f. Surfaces to be painted that are subject to leakage or spillage from a hydraulic system using fire resistant hydraulic fluid shall be coated with type V, class 5, grade A or PIN code M23236-B1A, machinery gray paint in accordance with MIL-PRF-23236. Manufacturer’s recommendations shall be followed for application.

g. Corrosion-resistant materials shall not be painted for the purpose of preservation.

3.20 Charts. Charts shall be in accordance with type F of MIL-DTL-15024 and MIL-P-15024/5.

3.20.1 Operating instruction chart. An operating instruction chart shall be provided for installation at each elevator control station and in the machinery room. Each chart shall give specific instructions for the operation of the elevator controls from that station.

3.20.2 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.

3.20.3 Key plan chart. A key plan chart shall be provided in each elevator machinery room. The chart shall identify the compartment location of the elevator trunk, each elevator control station, trunk door, trunk hatch, machinery room, stow level of the platform, and stowage location of all portable elevator equipment.

3.21 Safety markings.

3.21.1 Safe working load warning. A warning, “SAFE WORKING LOAD xxx LBS” (see 6.2.x), shall be provided on the outside of each door and inside the elevator trunk across from every door at each level. The warning may be a label plate or may be stenciled. Lettering of the warning shall be 2 inches high.

3.21.2 No-rider warning. A warning, “KEEP OFF THIS ELEVATOR WHEN IN OPERATION”, shall be provided on the outside of each door and inside the elevator trunk at each level. The warning may be a label plate or may be stenciled. Lettering of the warning shall be 2 inches high.

3.21.3 Elevator platform safety markings. Each shipboard elevator platform shall have a peripheral painted solid yellow safety margin to aid in ensuring that cargo/weapons loads do not hang over the platform (see figure 6). The safety margin shall extend from the platform's edges inboard 3 inches. Where a ramp extends onto the platform, the safety margin shall extend 3 inches beyond the maximum inboard extension of the ramp. The only exception is where wheeled dollies are used for the transfer of ordnance, in which case the platform's end edges and ramps shall have a safety margin of 5 inches, with the 3-inch requirement still applicable to the side edges. Platform mounted liferails and Emergency MEDEVAC enclosures shall be painted yellow.

3.21.4 Flush deck hatch safety markings. Elevator flush deck hatches shall have a red and yellow striped safety margin painted around the hatch opening (see figure 7).

3.21.5 Ramp safety markings. All mechanically, hydraulically, or electrically operated movable ramps shall be painted in black and yellow diagonal striping.

3.21.6 Door safety markings. A warning, "KEEP CLEAR DURING DOOR OPERATION", shall be provided on both sides of each powered door. The warning may be a placard or may be stenciled. Lettering of the warning shall be 2 inches high. Where the movement path of powered doors extends outside the elevator trunk, a 4-inch wide solid red painted safety margin shall be provided to denote those areas within which it is unsafe for personnel to stand during door operation. This safety margin shall be marked "KEEP CLEAR DURING DOOR OPERATION."

3.21.7 Platform load height safety markings. The underside of all hatches shall be provided with a red load line, 3 inches high and spanning the width of the hatch with the warning, "SAFE LOAD HEIGHT BELOW RED LINE" positioned above the red line. The height of the bottom edge of the red line above the platform while flush at the hatch level shall be not more than 3 inches lower than the lowest door clear opening on that elevator.

3.21.8 Manual override for powered closure markings. For closures provided with a means to override powered actuator controls, "WARNING" instructions shall be provided either stenciled or on a placard affixed to the surrounding area at each door or hatch control. Lettering shall be red on contrast background stating the following:

a. Personnel injury or death or serious damage to equipment can occur if actuation is not correctly sequenced.

b. Only qualified and trained personnel will manually operate the actuator controls.

c. All personnel will be properly briefed and permission must be granted from qualified designated divisional supervisory personnel prior to manually controlling any closure actuator.

d. Proper manning and positive communications must be established between all personnel to ensure that all closure and trunk areas are clear of equipment or personnel prior to manually controlling closure actuators.

e. Safety observers shall be in visual contact with the closure being operated. Positive communication between the safety observer monitoring the closure movement and the qualified operator shall be maintained until the operation is complete and normal elevator operation has been established.

3.22 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 and shall be in accordance with MIL-STD-130. Identification plates shall withstand exposure to AFFF without loss of legibility or adhesion to equipment.

3.23 Reliability.

3.23.1 Control system reliability requirements.

3.23.1.1 Hybrid relay control system. The hybrid relay control system shall not require replacement of component parts during a mean cycle between failures (MCBF) of 60,000 cycles at an operation rate of 15 cycles per hour for 10 hours a day (see 6.7.19 for the definition of failure). The cycle consists of 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.

3.23.1.2 PLC control system. The PLC control system shall not require replacement of component parts during a mean cycle between failures (MCBF) of 250,000 cycles at an operation rate of 15 cycles per hour for 10 hours a day (see 6.7.19 for the definition of failure). The cycle consists of 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.

3.23.2 Machinery reliability requirements. The elevator hoist machinery, sheaves, guide rails, platform assembly, and powered trunk closures shall not require replacement of component parts during an MCBF of 250,000 cycles at an operation rate of 15 cycles per hour for 10 hours a day. The cycle for elevator hoist machinery, sheaves, guide rails, and platform assembly consists of a round trip between the extremes of the elevator travel. The cycle for each elevator powered trunk closure and its associated machinery is one open and one closed operation (including all associated powered closure operations such as dogging, undogging, securing, etc.) per elevator hoist machinery cycle. The trunk closure cycling shall be accomplished during the 75-second wait time specified in 3.11.6.b. Exceptions to part replacement requirements are planned replacement type components such as brake pads.

3.24 Maintainability.

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

3.25 Condition monitoring features. The elevator shall monitor, record, and display the elevator performance, control switch status, and fault diagnostic messages in accordance with tables X, XI, and XII.

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 the operation, repair, or interchanging of any component or assembly. If elevator design deviates from this specification or if this specification is silent to a particular design aspect, then elevator system design shall incorporate system safety practices (see 6.2.ww), such as hazard analyses, fault tree analyses (FTA), and failure mode and effects criticality analyses (FMECA), to identify, classify, and manage mishap risk in accordance with MIL-STD-882 for review by the Technical Authority prior to acceptance.

3.27 Software requirements. All software necessary for the operation, adjustment, trouble-shooting, and re-programming of the elevator system programmable devices, PLC project files, HMI programs, and drive software, if utilizing a variable speed drive, shall be provided with the elevator system (see 6.2.zz). All elevator software provided shall be compatible with use on a portable computer using the operating system specified (see 6.2.xx), for the purpose of viewing and editing the project files, HMI programs, and drive software, if applicable, and for uploading and downloading the project files, HMI programs, and drive software, if applicable, to and from the elevator system via Ethernet using the communications protocols specified (see 6.2.xx). Additional software requirements shall be as specified (see 6.2.yy).

TABLE X. Elevator data to be monitored.

Elevator information	Data to display/record	Applicability	
		Elevators with hybrid relay logic control	Elevators with programmable logic control
Hoist machinery operation total hours	Elapsed hours hoist motor is energized	1/	2/, 3/, 4/
Hoist machinery starts	Total number of times hoist motor is energized	1/	2/, 3/, 4/
Hoist machinery low speed operation hours	Elapsed hours of hoist motor operation at low speed	N/A	2/, 3/, 4/
Hoist machinery high speed operation hours	Elapsed hours of hoist motor operation at high speed	N/A	2/, 3/, 4/
Hoist machinery jogging operation hours	Elapsed hours of hoist machinery jog mode operation	N/A	2/, 3/, 4/
Hydraulic power unit (motor/pump set) operation total hours	Elapsed hours each hydraulic power unit is energized	1/	2/, 3/, 4/ Applies only to elevators with hydraulically operated closures.
Hydraulic power unit (motor/pump set) on-stroke operation total hours	Elapsed hours each hydraulic power unit is energized and operating on-stroke	N/A	2/, 3/, 4/ Applies only to elevators with hydraulically operated closures.
Door cycles	Total number of times each door is opened	N/A	2/, 3/, 4/
Hatch cycles	Total number of times each hatch is opened	N/A	2/, 3/, 4/
Safety switch or safety circuit relay faults	Total number of trip events for each switch or relay in the SIR 115 circuit	N/A	2/, 3/, 4/
Hoist motor overtemperature trips	Number of times hoist motor overtemperature switch/relay trips	N/A	2/, 3/, 4/
Hoist machinery variable speed drive faults	Number and type of fault for each drive fault	N/A	2/, 3/, 4/
HMI faults	Number and type of faults for each HMI	N/A	2/, 3/, 4/
Control system faults	Number and type of each PLC and communication fault	N/A	2/, 3/, 4/
Dispatches	Total number of dispatches from each level served	N/A	2/, 3/, 4/
Laser diode operation hours	Elapsed hours laser diode is energized	N/A	2/, 3/, 4/

TABLE X. Elevator data to be monitored – Continued.

Elevator information	Data to display/record	Applicability	
		Elevators with hybrid relay logic control	Elevators with programmable logic control
Elevator control system operation total hours	Elapsed hours control system is energized (i.e., elapsed hours control system voltage is available)	1/	2/, 3/, 4/

NOTES:

1/ Monitor, display, and record data locally via counter.

2/ Monitor and record data locally via non-volatile flash memory.

3/ Monitor and display locally via the machinery room diagnostic terminal (see 3.13.1.12).

4/ Data to be accessible for monitoring, recording, and display via Ethernet connection to a portable computer using Ethernet protocols, as specified (see 6.2.xx).

3.28 Workmanship. Neatness, thoroughness, and inspection of welding shall be in accordance with S9074-AR-GIB-010/278. 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.

3.29 Cybersecurity. Cybersecurity (see 6.7.1) requirements shall be in accordance with MIL-DTL-32613.

3.30 Username and password. Username and password protection shall be provided in accordance with MIL-DTL-32613. Authorized personnel shall have the ability to modify passwords through the elevator system without connecting external hardware.

3.31 Logging. Logging shall be in accordance with MIL-DTL-32613.

3.32 Labeling. All physical devices requiring labeling shall be provided in accordance with MIL-DTL-15024, type B, style I. Nomenclature presented on HMI (GUI) screens shall be presented in accordance with MIL-STD-1472.

TABLE XI. Status indicators.

Elevator information	Data to display/record	Applicability	
		Elevators with hybrid relay logic control	Elevators with programmable logic control
Deck switch status screen	Shall have indicators that display all deck level proximity switches. Indicators shall be illuminated if the switch is energized and extinguished if the switch is not energized.	N/A	1/, 2/
Door switch status screen	Shall have indicators that display all door switches. Indicators shall be illuminated if the switch is energized and extinguished if the switch is not energized.	N/A	1/, 2/
Run/stop switch status screen	Shall have indicators that display all RUN/STOP switches. Indicators shall be illuminated green if the switch is in RUN and illuminated red if the switch is in STOP.	N/A	1/, 2/
Hatch switch status screen (when hatches are present)	Shall have indicators that display all hatch switches. Indicators shall be illuminated if the switch is energized and extinguished if the switch is not energized.	N/A	1/, 2/
Safety interlock status screen	Shall have indicators that display all components of the SIR 115. Indicators shall be illuminated green if the switch/relay is energized and illuminated red if the switch/relay is not energized.	N/A	1/, 2/

NOTES:

1/ Monitor and display locally via all HMI screens (see 3.13.3.17).

2/ Data to be accessible for monitoring, recording, and display via Ethernet connection to a portable computer using Ethernet protocols, as specified (see 6.2.xx).

TABLE XII. Diagnostic messages.

Screen	Data to display/record	Discrete messages
Door Error Diagnostic Screen	Shall display the corresponding diagnostic message when the operator attempts to operate a door and door operation is not permissible. Shall also provide indicators to identify the specific door where the DOOR ERROR occurred.	Door cannot be opened unless the RUN/STOP switch is in STOP.
		Door cannot be opened unless the platform is at the corresponding deck level.
		Door cannot be opened unless all other doors are fully closed.
		Door is opened and dogged; door must be undogged prior to closing the door.
		Door is closed with door ramp not retracted; door ramp must be retracted while door is closed.
		*** Door cannot be opened unless the flush deck hatch is fully closed.
Jog Error Diagnostic Screen	Shall display the corresponding diagnostic message when the operator attempts to jog the platform and jog operation is not permissible.	SEND command cannot be initiated when in Jog Mode.
		JOG command cannot be initiated with a RUN/STOP switch in STOP.
		JOG command cannot be initiated unless all doors are fully closed.
		Platform cannot be jogged off of deck level unless Jog Selector is in Maintenance Jog Mode.
		***E-STOW command cannot be initiated when in either Deck Jog or Maintenance Jog Mode.
		JOG command cannot be initiated unless Jog Selector is in either Deck Jog or Maintenance Jog Mode.
		JOG command cannot be initiated unless the SIR 115 is energized.
		JOG DOWN command cannot be initiated when a UOT/UTL condition exists without UOT/UTL Bypass energized.
		JOG UP command cannot be initiated when a DTL/Slack Rope/Overspeed Governor condition exists without SR/DTL Bypass energized.
		JOG UP command cannot be initiated when a UOT/UTL condition exists.
		JOG DOWN command cannot be initiated when a DTL/Slack Rope/Overspeed Governor condition exists.
		DECK JOG command cannot be initiated when UOT/UTL or SR/DTL Bypass is energized.

TABLE XII. Diagnostic messages – Continued.

Screen	Data to display/record	Discrete messages
Platform Error Diagnostic Screen	Shall display the corresponding diagnostic message when the operator attempts to operate the platform (other than in Jog Mode) and operation is not permissible.	SEND command cannot be initiated with a RUN/STOP switch in STOP.
		SEND command cannot be initiated unless all doors are fully closed.
		SEND command cannot be initiated while either UOT/UTL or SR/DTL Bypass is energized.
		SEND command cannot be initiated when platform is not at the corresponding deck level.
		SEND command cannot be initiated unless the SIR 115 is energized.
		***Platform is above the hatch sequence level with the flush deck hatch not fully open; platform must be jogged down to the hatch sequence level.
		***Platform is below the hatch sequence level with the in-trunk hatch not fully open; platform must be jogged up to the hatch sequence level.
		***Unknown platform location with the in-trunk hatch not fully open; platform location must be visually identified before jogging platform to the nearest deck level.
		***E-STOW command cannot be initiated while a Slack Rope/Overspeed Governor condition exists.
		***SEND command cannot be initiated unless the flush deck hatch is fully closed.
		***SEND command cannot be initiated with hatches out of sequence.
		***STOW/UNSTOW command cannot be initiated with hatches out of sequence.
		***Hatch Clear Timeout; Hatch Clear must be acknowledged within 30 seconds when the platform has been dispatched to the flush deck hatch level.
Control Fault Diagnostic Screen	Shall display the corresponding diagnostic message when a CONTROL FAULT occurs, prohibiting further operation of the platform.	Elevator wiring address fault.
		PLC fault.
		Power supply fault.
		Laser sensor fault.
		Communications fault (specify which module has/had lost communications).
		Intermittent platform fault: RUN/STOP switch Slack Rope/Overspeed Governor switch Door switch
		Missed Slow proximity switch (specify the switch that failed to actuate).
		Missed Stop proximity switch (specify the switch that failed to actuate).
		Missed laser sensor slow/stop position.
		Door fault.

TABLE XII. Diagnostic messages – Continued.

Screen	Data to display/record	Discrete messages
Control Fault Diagnostic Screen (continued)		Platform travel in wrong direction.
		***Flush deck hatch fault.
		***In-trunk hatch fault.

NOTES:

1. Monitor and display locally via all HMI screens (see 3.13.3.17).
2. Data to be accessible for monitoring, recording, and display via Ethernet connection to a portable computer using Ethernet protocols, as specified (see 6.2.xx).
3. Diagnostic messages marked with (***) are only applicable to elevators with either flush deck or in-trunk hatches.

4. VERIFICATION

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

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 First article inspection. When specified (see 6.2.aaa), first article inspection of the elevator system components shall be performed prior to shipboard installation and shall consist of the tests specified in 4.2.1 through 4.2.8, 4.4, and table XIII.

4.2.1 Overspeed governor. The overspeed governor shall be inspected for range of motion, freedom of movement, and interaction of moving parts. The overspeed governor shall then be mounted on a test bench and calibrated in accordance with 803-6397421, except that calibration shall be accomplished based on the average of ten trips; maximum variation between trips shall not exceed 5 rpm. A tripped overspeed governor shall not allow the governor wire rope to pull through the pinch roller when a pull-through force of 300 pounds is applied to the end of the overspeed governor wire rope corresponding to the platform upper connection point.

4.2.2 Electric motor and controller. The electric motor shall be coupled to its controller and tested.

4.2.2.1 Two-speed motor and controller. The electric motor shall be operated on a dynamometer for 50 cycles as specified in 3.11.3.7.g. The motor shall accelerate and decelerate as specified when the voltage applied is 440 (±10 percent) VAC. The motor and controller shall also be tested for operation for one cycle at each limit of input voltage, 484 VAC and 396 VAC.

4.2.2.2 Single-speed motor and variable drive. The electric motor shall be operated on a dynamometer for 50 cycles as specified in 3.11.3.8.g. The motor shall accelerate and decelerate as specified when the voltage applied is 440 (±10 percent) VAC. The motor and drive shall also be tested for operation for one cycle at each limit of input voltage, 484 VAC and 396 VAC.

4.2.3 Hoist machinery. When specified (see 6.2.bbb), the hoist machinery shall be connected to a test weight, which shall be raised and lowered by the hoist machinery to demonstrate the minimum hoist capability specified in table VI.

4.2.3.1 Low speed. The hoist machinery shall be operated at low speed with the load specified in 4.2.3 to simulate continuous slow speed travel between the lowest and highest level served by the elevator. Raise and lower operations shall each be conducted for 5 minutes, ensuring the elevator hoist motor low speed operating time does not exceed 10 minutes per hour.

4.2.3.2 Duty cycle. The hoist machinery shall be operated through 30 cycles of operation with the load as specified in 4.2.3. The motion profile for each cycle and pauses between cycles for this test shall simulate the duty cycle specified in 3.11.6.b except that the travel distance shall be 36 feet. During this test, the hoist machinery shall decelerate from high speed to low speed within a rotation that correlates to no more than 19 inches of platform travel.

4.2.3.3 Dynamic stopping. The hoist machinery shall be operated at rated speed with the load specified in 4.2.3 applied to simulate downward platform travel. After the hoist machinery has reached rated speed, the hoist machinery shall be de-energized to set the brake. The hoist machinery shall come to a complete stop within an amount of rotation that correlates to not more than 3 feet of platform travel. After a cool-down period of 2 hours, this test shall be repeated one time to demonstrate repeatability.

4.2.4 Disconnect switch. 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.

4.2.5 Airborne noise test. The hoist machinery shall be tested under normal operating conditions to duplicate shipboard installation in accordance with MIL-STD-1474.

4.2.6 High-impact shock tests. The components shall be tested for high-impact shock in accordance with MIL-DTL-901 for the shock grade, as specified (see 6.2 h). Elevator components being shock tested shall be configured to approximate the configuration specified in 3.3.25.

4.2.7 Vibration tests. The components shall be tested to verify compliance with type I vibration criteria in accordance with MIL-STD-167-1.

4.2.8 Electromagnetic compatibility tests. Electronic components shall be tested in accordance with MIL-STD-461. Electronic components shall comply with the susceptibility and emissions requirements of MIL-STD-461.

4.3 Conformance inspection. Conformance inspection, as specified (see 6.2.ccc), shall include the shop tests of 4.3.1 through 4.3.3, examinations of 4.4, and the tests of 4.5 as specified in table XIII.

4.3.1 Overspeed governor shop test. The overspeed governor shall be inspected for range of motion, freedom of movement, and interaction of moving parts. The overspeed governor shall then be mounted on a test bench and calibrated in accordance with 803-6397421, except that calibration shall be accomplished based on the average of ten trips; maximum variation between trips shall not exceed 5 rpm. A tripped overspeed governor shall not allow the governor wire rope to pull through the pinch roller when a pull-through force of 300 pounds is applied to the end of the overspeed governor wire rope corresponding to the platform upper connection point.

4.3.2 Two-speed motor shop test. The electric motor shall be operated on a dynamometer for 50 cycles as specified in 3.11.3.7.g. The motor shall accelerate and decelerate as specified when the voltage applied is 440 (±10 percent) VAC.

4.3.3 Single-speed motor shop test. The electric motor shall be operated on a dynamometer for 50 cycles as specified in 3.11.3.8.g. The motor shall accelerate and decelerate as specified when the voltage applied is 440 (±10 percent) VAC.

TABLE XIII. Verification.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Material and component	3.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Brittle material	3.2.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Aluminum	3.2.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Steel plate	3.2.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Cast steel	3.2.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Forged steel	3.2.5	4.4, 4.5.3, 4.5.4	N/A	X	X
Asbestos	3.2.6	4.4, 4.5.3, 4.5.4	N/A	X	X
Cadmium plating	3.2.7	4.4, 4.5.3, 4.5.4	N/A	X	X
Fabrication and welding	3.2.8	4.4, 4.5.3, 4.5.4	N/A	X	X
Castings	3.2.9	4.4, 4.5.3, 4.5.4	N/A	X	X
Mercury	3.2.10	4.4, 4.5.3, 4.5.4	N/A	X	X
Recycled, recovered, environmentally friendly, or biobased materials	3.2.11	N/A	N/A	--	--
Dissimilar metals	3.2.12	N/A	N/A	X	X
Lubricants and hydraulic fluids	3.2.13	N/A	N/A	X	X
Design	3.3	N/A	N/A	--	--
Design philosophy	3.3.1	N/A	N/A	--	--
Storm sea conditions	3.3.2	4.5.3, 4.5.4	N/A	X	--
Moderate sea conditions	3.3.3	4.5.3, 4.5.4	4.5.9	X	X
Temperature	3.3.4	4.5.3, 4.5.4	4.5.18	X	--
Life	3.3.5	4.5.3, 4.5.4	4.5.18	X	--
Manning	3.3.6	4.5.3, 4.5.4	4.5.7, 4.5.8	X	X
Fail-safe	3.3.7	4.5.3, 4.5.4	4.5.6.1, 4.5.6.3, 4.5.6.4, 4.5.9, 4.5.17	X	X
Lubrication fittings	3.3.8	4.4, 4.5.3, 4.5.4	N/A	X	X
Keyways	3.3.9	4.4, 4.5.3, 4.5.4	N/A	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Bearings and bushings	3.3.10	4.4, 4.5.3, 4.5.4	N/A	X	X
Screw threads	3.3.11	4.4, 4.5.3, 4.5.4	N/A	X	X
Threaded fasteners	3.3.12	4.4, 4.5.3, 4.5.4	N/A	X	X
Thread protrusion	3.3.13	4.4, 4.5.3, 4.5.4	N/A	X	X
Thread engagement strength	3.3.14	4.4, 4.5.3, 4.5.4	N/A	X	X
Thread engagement dimensions	3.3.15	4.4, 4.5.3, 4.5.4	N/A	X	X
Bottom tapping	3.3.16	4.4, 4.5.3, 4.5.4	N/A	X	X
Foundation bolting	3.3.17	4.4, 4.5.3, 4.5.4	N/A	X	X
Through bolts	3.3.18	4.4, 4.5.3, 4.5.4	N/A	X	X
Nuts	3.3.19	4.4, 4.5.3, 4.5.4	N/A	X	X
Foundation alignment	3.3.20	4.4, 4.5.3, 4.5.4	N/A	X	X
Assembly of aluminum parts	3.3.21	4.4, 4.5.3, 4.5.4	N/A	X	X
Sintered metal fasteners	3.3.22	4.4, 4.5.3, 4.5.4	N/A	X	X
Thread locking compound	3.3.23	4.4, 4.5.3, 4.5.4	N/A	X	X
Lifting gear	3.3.24	4.4, 4.5.3, 4.5.4	N/A	X	X
Shock	3.3.25	N/A	4.2.6	X	--
Vibration	3.3.26	N/A	4.2.7	X	--
Explosion proof	3.3.27	4.4, 4.5.3, 4.5.4	N/A	X	X
Axis of rotation	3.3.28	4.5.3, 4.5.4	N/A	X	X
Noise	3.3.29	N/A	4.2.5	X	--
Components exposed to harsh environment	3.3.30	4.4, 4.5.3, 4.5.4	N/A	X	--
Particulates	3.3.31	4.4, 4.5.3, 4.5.4	N/A	X	--
Paint overspray	3.3.32	4.4, 4.5.3, 4.5.4	N/A	X	--
Levels served	3.3.33	4.4, 4.5.3, 4.5.4	N/A	X	X
Trunk	3.3.34	4.4, 4.5.3, 4.5.4	N/A	X	X
Pit	3.3.34.1	4.4, 4.5.3, 4.5.4	N/A	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Deck extensions and gratings	3.3.34.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Trunk closures	3.3.35	4.4, 4.5.3, 4.5.4	N/A	X	X
Trunk closure damage control requirements	3.3.35.1	4.4, 4.5.3, 4.5.4	4.5.21	X	X
Door operation	3.3.35.2	4.4, 4.5.3, 4.5.4	4.5.17	X	X
Hatch operation	3.3.35.3	4.4, 4.5.3, 4.5.4	4.5.17	X	X
Ramps	3.3.35.4	4.4, 4.5.3, 4.5.4	4.5.17	X	X
Trunk closure emergency operation	3.3.35.5	4.4, 4.5.3, 4.5.4	4.5.17	X	X
Elevator access control	3.3.36	4.4, 4.5.3, 4.5.4	N/A	X	X
Human engineering	3.3.37	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.19	X	X
Safety factors and maximum allowable stress	3.4	N/A	N/A	--	--
Wire rope	3.4.1	N/A	4.5.22	X	--
Component structural stress limits	3.4.2	N/A	4.5.23	X	--
Platform	3.5	N/A	N/A	--	--
Platform design	3.5.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Platform performance	3.5.2	4.4, 4.5.3, 4.5.4	4.5.5, 4.5.9, 4.5.10	X	X
Platform capacity	3.5.2.1	4.4, 4.5.3, 4.5.4	4.5.5, 4.5.9, 4.5.10	X	X
Loading design load	3.5.2.2	4.4, 4.5.3, 4.5.4	4.5.5	X	X
Platform deck loading	3.5.2.3	4.4, 4.5.3, 4.5.4	4.5.5	X	--
Platform deflection	3.5.2.4	4.4, 4.5.3, 4.5.4	4.5.5	X	--
Platform physical characteristics	3.5.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Platform weight and dimensions	3.5.3.1	4.4, 4.5.3, 4.5.4	N/A	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Platform safety linkage	3.5.3.2	4.4, 4.5.3, 4.5.4	4.5.6.1, 4.5.6.2, 4.5.6.3	X	X
Buffer spring contact surfaces	3.5.3.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Platform deck	3.5.3.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Platform tie-down fittings	3.5.3.5	4.4, 4.5.3, 4.5.4	4.5.5	X	X
Platform personnel fall arrest anchorages	3.5.3.6	4.4, 4.5.3, 4.5.4	4.5.5	X	X
Platform liferails	3.5.3.7	4.4, 4.5.3, 4.5.4	N/A	X	X
MEDEVAC enclosures	3.5.3.8	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Platform mounted switch vanes, cams	3.5.3.9	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Platform running clearance	3.5.3.10	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Platform power	3.5.3.11	4.4, 4.5.3, 4.5.4	N/A	X	X
Safety devices	3.6	N/A	N/A	--	--
Safety device design requirements	3.6.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Broken rope safety device	3.6.2	4.4, 4.5.3, 4.5.4	4.5.6.1	X	X
Overspeed governor	3.6.3	4.4, 4.5.3, 4.5.4	4.5.6.2, 4.5.6.4	X	X
Overspeed governor slack rope device	3.6.4	4.4, 4.5.3, 4.5.4	4.5.6.3	X	X
Hoist slack rope device	3.6.5	4.4, 4.5.3, 4.5.4	4.5.15	X	X
Guide rails and guide shoes	3.7	N/A	N/A	--	--
Guide rails	3.7.1	4.4, 4.5.3, 4.5.4	4.5.6.4	X	X
Guide shoes, guide rollers, and knurled safety rollers	3.7.2	4.4, 4.5.3, 4.5.4	4.5.6.1, 4.5.6.4, 4.5.7, 4.5.10	X	X
Hoisting rope	3.8	4.4, 4.5.3, 4.5.4	N/A	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Buffer spring assemblies	3.9	4.4, 4.5.3, 4.5.4	N/A	X	X
Sheaves	3.10	4.4, 4.5.3, 4.5.4	4.5.5, 4.5.7, 4.5.9	X	X
Hoist machinery	3.11	N/A	N/A	--	--
Hoist machinery classes	3.11.1	N/A	N/A	X	X
Characteristics	3.11.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Performance	3.11.3	N/A	4.5.7, 4.5.8, 4.5.9, 4.5.10, 4.5.18	X	X
Two-speed hoist machinery performance	3.11.3.1	N/A	4.5.7, 4.5.8, 4.5.9, 4.5.10	X	X
Variable speed machinery performance	3.11.3.2	N/A	4.5.7, 4.5.8, 4.5.9, 4.5.10	X	X
Stopping performance	3.11.3.3	N/A	N/A	--	--
Normal stopping performance	3.11.3.3.1	N/A	4.5.7, 4.5.8, 4.5.9, 4.5.10	X	X
High speed stopping performance	3.11.3.3.2	N/A	4.5.7, 4.5.8, 4.5.9, 4.5.10	X	X
Hoisting drums	3.11.3.4	N/A	N/A	--	--
Hoisting drum arrangement	3.11.3.4.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Hoisting drum diameter	3.11.3.4.2	4.4, 4.5.3, 4.5.4	4.5.10	X	X
Hoisting drum configuration	3.11.3.4.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Overspeed governor drum	3.11.3.4.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Safety guards	3.11.3.5	4.4, 4.5.3, 4.5.4	N/A	X	X
Speed reducer	3.11.3.6	4.4, 4.5.3, 4.5.4	4.5.10	X	X
Gearing	3.11.3.6.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Housing	3.11.3.6.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Lubrication	3.11.3.6.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Lubricants	3.11.3.6.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Two-speed electric hoist motor	3.11.3.7	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8, 4.5.9,4.5.10	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Variable speed electric hoist motor	3.11.3.8	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8, 4.5.9,4.5.10	X	X
Hoist machinery brake	3.11.3.9	4.4, 4.5.3, 4.5.4	4.5.5, 4.5.7, 4.5.9, 4.5.10	X	X
Couplings	3.11.3.10	4.4, 4.5.3, 4.5.4	N/A	X	X
Hoisting drum shafting and bearings	3.11.3.11	4.4, 4.5.3, 4.5.4	N/A	X	X
Bedplate	3.11.3.12	4.4, 4.5.3, 4.5.4	N/A	X	X
Physical characteristics	3.11.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Dimensional limitations	3.11.5	4.4, 4.5.3, 4.5.4	N/A	X	X
Duty cycle	3.11.6	N/A	4.2.3.2	X	N/A
General requirements for electrical equipment	3.12	N/A	N/A	--	--
Electrical equipment	3.12.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Electromagnetic compatibility	3.12.1.1	N/A	4.2.8	X	--
Electric enclosures	3.12.1.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Grounding and bonding	3.12.1.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Cable and connections	3.12.1.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Cable connectors	3.12.1.5	4.4, 4.5.3, 4.5.4	N/A	X	X
Junction boxes	3.12.1.6	4.4, 4.5.3, 4.5.4	N/A	X	X
Cable feed through	3.12.1.7	4.4, 4.5.3, 4.5.4	N/A	X	X
Terminal boards	3.12.1.8	4.4, 4.5.3, 4.5.4	N/A	X	X
Wire markings	3.12.1.9	4.4, 4.5.3, 4.5.4	N/A	X	X
Control system	3.13	N/A	N/A	--	--
Control system components	3.13.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Two-speed motor controller	3.13.1.1	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8, 4.5.9, 4.5.10	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Variable speed drive	3.13.1.2	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8, 4.5.9, 4.5.10	X	X
Platform (logic) controller	3.13.1.3	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8	X	X
Hybrid Relay Logic Control	3.13.1.3.1	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8	X	X
Solid-State Programmable Logic Control	3.13.1.3.2	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8	X	X
Dual hatch controller	3.13.1.4	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
Machinery room control station	3.13.1.5	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8, 4.5.11	X	X
Master control station	3.13.1.6	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8, 4.5.11	X	X
Master control station (dual hatch)	3.13.1.7	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.11	X	X
Secondary control station (dual hatch)	3.13.1.8	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.11	X	X
Recessed control station	3.13.1.9	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.11	X	X
Deck level control station	3.13.1.10	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.11	X	X
Power disconnect switch	3.13.1.11	4.4, 4.5.3, 4.5.4	4.2.4	X	X
Machinery room diagnostic terminal	3.13.1.12	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Control system function	3.13.2	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.8	X	X
Control system design requirements	3.13.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Control system safety features	3.13.3.1	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
Dead-man feature	3.13.3.1.1	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
UOT	3.13.3.1.2	4.4, 4.5.3, 4.5.4	4.5.16	X	X
UTL	3.13.3.1.3	4.4, 4.5.3, 4.5.4	4.5.7	X	X
DTL	3.13.3.1.4	4.4, 4.5.3, 4.5.4	4.5.7	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Overspeed governor	3.13.3.1.5	4.4, 4.5.3, 4.5.4	4.5.6.2, 4.5.6.4	X	X
Overspeed governor slack rope device	3.13.3.1.6	4.4, 4.5.3, 4.5.4	4.5.6.3	X	X
Hoist slack rope device	3.13.3.1.7	4.4, 4.5.3, 4.5.4	4.5.15	X	X
Terminal level up high speed stop	3.13.3.1.8	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Terminal level down high speed stop	3.13.3.1.9	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Hatch sequence level up high speed stop	3.13.3.1.10	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Hatch sequence level down high speed stop	3.13.3.1.11	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Door interlocks	3.13.3.1.12	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
Hatch interlocks	3.13.3.1.13	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
Trunk interference interlocks	3.13.3.1.14	4.4, 4.5.3, 4.5.4	4.5.7	X	X
E-STOP pushbuttons	3.13.3.1.15	4.4, 4.5.3, 4.5.4	4.5.11	X	X
Emergency stow	3.13.3.1.16	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Stow	3.13.3.1.17	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Unstow	3.13.3.1.18	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Run/stop switch	3.13.3.2	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Run/stop/cancel E-stow switch	3.13.3.2.1	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Door control	3.13.3.3	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
Flush deck hatch control	3.13.3.4	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
In-trunk hatch control	3.13.3.5	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.17	X	X
Bypass switch	3.13.3.6	4.4, 4.5.3, 4.5.4	4.5.7, 4.5.6.3, 4.5.15	X	X
Maintenance and deck jog controls	3.13.3.7	4.4, 4.5.3, 4.5.4	N/A	--	--
Deck jog	3.13.3.7.a	4.4, 4.5.3, 4.5.4	4.5.8.2	X	X
Maintenance jog	3.13.3.7.b	4.4, 4.5.3, 4.5.4	4.5.8.1	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Emergency run	3.13.3.8	4.4, 4.5.3, 4.5.4	4.5.12	X	X
Emergency jog controls	3.13.3.9	4.4, 4.5.3, 4.5.4	4.5.13	X	X
SIR 115 circuit	3.13.3.10	4.4, 4.5.3, 4.5.4	4.5.6.2, 4.5.6.3, 4.5.7, 4.5.12, 4.5.15	X	X
Power disconnect safety circuit	3.13.3.11	4.4, 4.5.3, 4.5.4	4.2.4, 4.5.7, 4.5.11	X	X
Deck level control switches	3.13.3.12	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Duplicate slow switches	3.13.3.13	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Proximity switches and limit switches	3.13.3.14	4.4, 4.5.3, 4.5.4	N/A	X	X
Laser sensor	3.13.3.15	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Relays	3.13.3.16	4.4, 4.5.3, 4.5.4	N/A	X	X
Touchscreen HMIs	3.13.3.17	4.4, 4.5.3, 4.5.4	4.5.7	X	X
High speed stop test switch	3.13.3.18	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Drift jog	3.13.3.19	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Solenoids	3.14	4.4, 4.5.3, 4.5.4	N/A	X	X
Communications	3.15	4.4, 4.5.3, 4.5.4	4.5.7	X	X
MEDEVAC communications	3.15.1	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Trunk powered closure system	3.16	N/A	N/A	--	--
Trunk powered closure system function	3.16	4.4, 4.5.3, 4.5.4	4.5.17	X	X
Hydraulic closure system	3.16.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Hydraulic power unit	3.16.1.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Hydraulic closure circuit	3.16.1.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Solenoid operated valves	3.16.1.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Electric closure system	3.16.22	4.4, 4.5.3, 4.5.4	N/A	X	X

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Hatch stanchions	3.17	4.4, 4.5.3, 4.5.4	4.5.7	X	X
Lighting	3.18	4.4, 4.5.3, 4.5.4	4.5.20	X	X
Painting	3.19	4.4, 4.5.3, 4.5.4	N/A	X	X
Charts and markings	3.20	4.4, 4.5.3, 4.5.4	N/A	X	X
Operating instructions chart	3.20.1	4.4, 4.5.3, 4.5.4	N/A	X	X
Lubrication chart	3.20.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Key plan chart	3.20.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Safety markings	3.21	N/A	N/A	--	--
Safe working load warning	3.21.1	4.4, 4.5.3, 4.5.4	N/A	X	X
No rider warning	3.21.2	4.4, 4.5.3, 4.5.4	N/A	X	X
Elevator platform safety markings	3.21.3	4.4, 4.5.3, 4.5.4	N/A	X	X
Flush deck hatch safety markings	3.21.4	4.4, 4.5.3, 4.5.4	N/A	X	X
Ramp safety markings	3.21.5	4.4, 4.5.3, 4.5.4	N/A	X	X
Door safety markings	3.21.6	4.4, 4.5.3, 4.5.4	N/A	X	X
Platform load height safety markings	3.21.7	4.4, 4.5.3, 4.5.4	N/A	X	X
Manual override for powered closure markings	3.21.8	4.4, 4.5.3, 4.5.4	N/A	X	X
Identification and product marking	3.22	4.4, 4.5.3, 4.5.4	N/A	X	X
Reliability	3.23	4.5.18	N/A	X	--
Definition of failure	N/A	N/A	N/A	--	--
Control system reliability requirements	3.23.1	N/A	4.5.18	X	--
Machinery reliability requirements	3.23.2	N/A	4.5.18	X	--
Maintainability	3.24	N/A	N/A	--	--
Maintainability requirement	3.24.1	4.4, 4.5.3, 4.5.4	4.5.19	X	--

TABLE XIII. Verification – Continued.

Applicable requirement	Applicable requirement sections	Applicable verification examination sections	Applicable verification test sections	First article inspection (see 4.2)	Conformance inspection (see 4.3)
Condition monitoring features	3.25	4.4, 4.5.3, 4.5.4	N/A	X	X
System safety	3.26	N/A	4.5.24	X	--
Software requirements	3.27	N/A	4.5.25, 4.5.26	X	X
Workmanship	3.28	4.4, 4.5.3, 4.5.4	N/A	X	X
Cybersecurity	3.29	4.4, 4.5.3, 4.5.4	N/A	X	X
Username and password	3.30	4.4, 4.5.3, 4.5.4	4.5.27	X	X
Logging	3.31	4.4, 4.5.3, 4.5.4	4.5.28	X	X
Overspeed governor	N/A	N/A	4.2.1	X	--
Two-speed motor & controller	N/A	N/A	4.2.2.1	X	--
Single-speed motor & variable drive	N/A	N/A	4.2.2.2	X	--
Hoist machinery	N/A	N/A	4.2.3	X	--
Disconnect switch	N/A	N/A	4.2.4	X	--
Noise test	N/A	N/A	4.2.5	X	--
Shock test	N/A	N/A	4.2.6	X	--
Vibration test	N/A	N/A	4.2.7	X	--
Electromagnetic compatibility test	N/A	N/A	4.2.8	X	--
Overspeed governor shop test	N/A	N/A	4.3.1	--	X
Two-speed motor shop test	N/A	N/A	4.3.2	--	X
Single-speed motor shop test	N/A	N/A	4.3.3	--	X

4.4 Conformance examination. The elevator system shall be examined for any defects jeopardizing the requirements of this specification, which shall include the specific items of table XIV.

TABLE XIV. Classification of defects.

	Defect
Critical	
1	Cybersecurity not in accordance with MIL-DTL-32613.
Major	
101	Material not as specified.
102	Parts, components, or accessories incomplete, missing, or not as specified.
103	Misalignment of components, machinery, or bedplate.
104	Assemblies and components not readily accessible for maintenance and repairs.
105	Casting not examined in accordance with the requirement of S9074-AR-GIB-010/278.
106	Fabrication, welding, and examination for machinery not in accordance with S9074-AR-GIB-010/278.
107	Welder and equipment qualification not in accordance with S9074-AR-GIB-010/278.
108	Parts hazardous to operating and maintenance personnel not fully enclosed, properly guarded, or insulated.
109	Platform not as specified.
110	Hoist machinery not as specified.
111	Control system not as specified.
112	Trunk closures not as specified.
113	Hoist machinery controls not as specified.
114	Trunk closure machinery or controls not as specified.
115	Control stations not as specified.
116	Controls, indicators, or displays not viewable, legible, or accessible to operator, or not as specified.
117	Safety devices, safety features, or safety markings not as specified.
118	Lubrication not as specified.
119	Guide rails not as specified.
120	Wire ropes, sheaves, drums, or fittings not as specified.
121	Trunk not as specified.
122	Each item of equipment not marked in a conspicuous manner on lubrication charts to indicate the grades of oils and greases used.
123	Identification markings, instruction, information, and warning plates incorrect, illegible, or missing.
124	Surface treatment and painting not as specified.
125	Workmanship not as specified.
126	Standard parts not being used where practicable.
127	Bearings not as specified.

4.5 Conformance tests.

4.5.1 Test procedures. After installation, the elevator system shall be tested for acceptable performance and for compliance with the requirements in this specification. The tests shall be conducted in accordance with the approved test plan, as specified (see 6.2.ddd). All equipment devices and accessories necessary for conducting the test shall be furnished by the contractor.

4.5.2 Instrumentation and instrumentation records. Test instruments shall be accurately calibrated and of a sensitivity appropriate for determining performance characteristics. A digital data display shall be made for all dynamic tests. Test instruments shall be calibrated in accordance with ISO 10012. All test weights shall be verified for accuracy as specified in 6.2.eee and shall be provided to within +5/-0 percent of desired test load.

4.5.3 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. Hoist motor
b. Speed reducer
c. Hoist machinery brake
d. Hoisting drums
e. Overspeed governor
f. Couplings
g. Pillow blocks
h. Shafts
i. Bedplate
j. Hoist machinery motor controller or variable speed drive
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
r. Hydraulic power unit
s. Platform assembly
t. Hangar deck control station
u. Recessed control station
v. Trunk closure operating machinery and controls
w. Portable elevator equipment
x. Emergency MEDEVAC enclosure
y. Machinery room diagnostic terminal
z. Trunk closures
aa. Laser sensor (if applicable)
bb. Cybersecurity implementations

4.5.4 Completed equipment.

a. Examination of the completed equipment shall be conducted to determine that all parts and components are assembled, oriented, and mounted as specified on the applicable drawings.

b. All parts which require access for operation, maintenance, repair, replacement, or periodic adjustment during the life of the equipment are readily accessible.

c. All parts and components are correctly marked with identifying symbols.

d. All electrical connections are terminated, located, and identified in accordance with the applicable drawing.

e. All completed equipment conforms to the material, arrangement, and dimensional requirements specified.

f. All control stations are readily accessible to the operator and allow the operator to safely observe the equipment being controlled by that control station.

g. All programmable devices have the correct software and programs loaded and programmable parameters correctly set.

4.5.5 Static load test. Elevator platform, hoist rope assemblies, hoisting machinery, sheaves and their associated foundations, and mounting hardware shall be static tested as follows:

a. Elevators loaded/unloaded by fork trucks or other self-propelled mobile handling equipment shall be tested by simultaneously 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. After 10 minutes, the loads shall be switched and the equipment tested for 10 more minutes.

b. All other elevators shall be tested by supporting a load of 200 percent of rated load centered on the platform for 10 minutes.

c. Platform tie-down fittings shall be pull tested in accordance with 803-1916300, 804-5184187, or 804-5184191, as appropriate.

d. Fall arrest terminal fittings on the platform shall be pull tested in accordance with 804-5184187.

During these tests, no part of the equipment shall fail, come adrift, exhibit permanent deformation, or 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.

4.5.6 Mechanical safety device tests.

4.5.6.1 Broken rope safety device test. The undercar linkage shall be checked to ensure that it operates to set the knurled rollers as follows:

a. Clamps or other securing devices shall be installed on the two hoist rope platform connections on one side of the platform such that loss of tension on these two hoist ropes will not cause actuation of the broken rope safety device.

b. The platform shall be lowered onto the spring buffers to create a slack rope condition. Platform safety linkage shall be verified to ensure that it operates to set the knurled rollers. Knurled rollers shall be considered to have set when they are in contact with the guide rails.

c. Hoist ropes shall be retensioned. Safety linkage resets and the knurled rollers shall be verified to ensure that they have returned to their housing pockets.

d. Clamps or other securing devices installed in step 4.5.6.1.a shall be removed.

e. The platform shall be jogged up to re-tension wire ropes. All linkage shall be verified to ensure that it has retracted and that the knurled rollers have returned to their housing pockets.

f. The steps above shall be repeated for each remaining side and end of the platform.

4.5.6.2 Overspeed governor, test 1 (slow speed, no load). The actuation of the overspeed governor shall cause the undercar linkage to set the knurled rollers as follows:

a. The overspeed governor bench test (see 4.3.1) shall be completed. With no load on the platform, the platform shall be lowered manually by operating hoist machinery brake manual release. While the platform is moving, the overspeed governor shall be actuated using the overspeed governor manual trip screw.

b. The overspeed governor flyweight face shall be verified to ensure that it has contacted and actuated the stopblock and that the overspeed governor proximity switch has actuated, platform has stopped, hoist motor has de-energized, and hoist brake has set.

c. Hoist ropes shall be verified to ensure that they have become slack.

d. The linkage shall be inspected to determine whether knurled rollers set. All knurled rollers shall be verified to ensure that they have been actuated to engage the guide rails and arrest platform downward movement. Platform tilt shall be verified to ensure that it does not exceed 0.25 inch per linear foot.

e. The overspeed governor trip screw shall be removed.

f. Using the bypass, the platform shall be jogged up approximately 1 foot.

g. The overspeed governor, knurled rollers, and platform safety linkage shall be verified to have reset and hoist ropes are no longer slack. Hoist ropes shall be verified to have properly wound onto hoist drums.

If the linkage operates to set knurled rollers and stops and holds elevator with less than 0.25 inch per linear foot of tilt, and governor switch removes power from the hoisting motor and sets the brake, the test is acceptable.

4.5.6.3 Overspeed governor slack rope device test. Slack shall be created in the overspeed governor wire rope and the platform shall be verified to ensure that it cannot be dispatched up or down. Turn the slack rope BYPASS switch to BYPASS and verify that the platform can be jogged.

4.5.6.4 Overspeed governor test 2 (high speed, rated load). Operation of the overspeed governor shall be verified to ensure that it will cause actuation of the undercar linkage and knurled rollers to stop and hold the platform when traveling with rated load at rated speed. The test shall be performed as follows:

a. The overspeed governor bench test (see 4.2.1) shall be completed and the overspeed governor shall be calibrated to actuate when platform speed reaches between 140 and 150 feet/minute. The governor adjustment shall be sealed and tag governor with date of test.

b. The overspeed governor stopblock shall be manually operated to actuate the overspeed governor switch. Verify switch actuates.

c. The overspeed governor shall be manually reset.

d. The platform shall be positioned at least two decks above the lower terminal level.

e. The rated load shall be positioned on elevator platform.

f. The overspeed governor manual trip screw shall be installed and tightened until the stopblock clears the flyweights by approximately 0.125 inch.

g. The elevator shall be dispatched down to the next lower level served. When the platform reaches high speed, the overspeed governor manual trip screw shall be tightened until the flyweights strike the stopblock and the overspeed governor trips.

h. The overspeed governor flyweight face shall be verified to ensure that it has contacted and actuated the stopblock and that the overspeed governor proximity switch has actuated, platform has stopped, hoist motor has de-energized, and hoist brake has set.

i. The hoist ropes shall become slack.

j. The linkage shall be inspected to determine if knurled rollers set. All knurled rollers shall be actuated to engage the guide rails and arrest platform downward movement. Platform tilt shall not exceed 0.25 inch per linear foot.

k. The overspeed governor trip screw shall be removed.

l. Using the bypass, the platform shall be jogged up approximately 1 foot.

m. The overspeed governor, knurled rollers, and platform safety linkage shall reset and hoist ropes shall no longer be slack. The hoist ropes shall properly wind onto hoist drums.

n. The platform and guide rails shall be inspected. Verify that knurled rollers and platform safety linkage have reset. The platform and guide rail shall not have been damaged by test. Surface deformation of the guide rail faces and knurled roller wear plate faces in way of knurled roller contact shall be permissible so long as the deformation does not prevent further elevator operation and guide rail deformation is repairable by welding and grinding.

If the linkage operates to set knurled rollers and stops and holds elevator with less than 0.25 inch per linear foot of tilt, and governor switch removes power from the hoisting motor and sets the brake, the test is acceptable. No part of the equipment shall fail, come adrift, exhibit permanent deformation, or experience degradation of any operating or control function as a result of the test. Permanent surface deformation of the knurled safety roller wear plates and guide rail in way of knurled safety roller contact is acceptable if it does not prevent elevator operation.

4.5.7 No-load test. The elevator shall be operated through 15 complete cycles of hoist and lower operation through the full hoisting range at rated-speed with an unloaded platform. After completing the 15 cycles, the elevator shall continue to operate with no load to and from each level served as needed to verify proper operation of the following features or functions listed in table XV.

TABLE XV. No-load test.

Test	Verification requirement
15 cycles	Complete 15 cycles of hoist and lower operations through the full hoisting range at rated-speed with an unloaded platform.
Deck level control switches, duplicate slow switches, and dispatch function	Operation of elevator dispatch controls, deck level control switches, and duplicate slow switches as specified in 3.13.1.6 through 3.13.1.10, 3.13.3.12, and 3.13.3.13 for each level served. Verify platform can only be dispatched when it is stopped at the sending level and all deck level proximity switches at that sending level are actuated.
Laser sensor and dispatch function	Operation of elevator dispatch controls and laser sensor as specified in 3.13.1.6 through 3.13.1.10 and 3.13.3.15 for each level served. Verify platform can only be dispatched when it is stopped at the sending level in accordance with the laser sensor feedback.
Platform acceleration to high speed	Verify platform accelerates to high speed in direction of each selected destination deck when dispatched. Verify this requirement is met for each dispatch cycle to/from each level served.
Platform deceleration	Verify platform fully decelerates from high speed to slow speed when approaching each selected destination deck. Verify this requirement is met for each dispatch cycle to/from each level served.
Platform normal stopping	Verify platform decelerates from slow speed to a complete stop and stops within 0.25 inch of each selected destination deck. Verify this requirement is met for each level served.
UOT and bypass	Verify UOT function as specified in 3.13.3.1.2 and can be bypassed as specified in 3.13.3.6.
UTL 1/	Verify UTL function as specified in 3.13.3.1.3 and can be bypassed as specified in 3.13.3.6.
DTL 2/	Verify DTL function as specified in 3.13.3.1.4 and can be bypassed as specified in 3.13.3.6.
Run/stop	Verify each run/stop functions as specified in 3.13.3.2.
Hatch sequence level up high speed stop 1/	Verify hatch sequence level up high speed stop functions as specified in 3.13.3.1.10.

TABLE XV. No-load test – Continued.

Test	Verification requirement
Hatch sequence level down high speed stop 2/	Verify hatch sequence level down high speed stop functions as specified in 3.13.3.1.11.
Terminal level up high speed stop	Verify terminal level up high speed stop functions as specified in 3.13.3.1.8.
Terminal level down high speed stop	Verify terminal level down high speed stop functions as specified in 3.13.3.1.9.
Door interlocks 3/	Verify door interlocks and door interlock emergency bypass function as specified in 3.13.3.1.12 for each trunk door.
Door controls 3/	Verify all door controls function as specified in 3.13.3.3.
Hatch interlocks 4/	Verify hatch interlocks function as specified in 3.13.3.1.13 for each trunk hatch.
Flush deck hatch controls 1/	Verify flush deck hatch controls function as specified in 3.13.3.4.
In-trunk hatch controls 2/	Verify in-trunk hatch controls function as specified in 3.13.3.5.
E-stow 1/	Verify E-stow functions as specified in 3.13.3.1.16.
Stow and unstow 5/	Verify stow and unstow functions as specified in 3.13.3.1.17 and 3.13.3.1.18.
Run/stop/cancel E-stow 1/	Verify run/stop/cancel E-stow functions as specified in 3.13.3.2.1.
Dispatch while in jog mode	Verify platform cannot be dispatched when jog selector is in DECK JOG or MAINTENANCE JOG position, as specified in 3.13.3.7.
Trunk interference interlocks (if applicable) 6/	Verify all trunk interference interlocks function as specified in 3.13.3.1.14.
All operator controls, indicator lights, and displays	Verify all operator controls, displays, and indicator lights function correctly.
Voice communication equipment	Verify voice communications equipment functions as specified in 3.15.
Portable equipment	Verify operability and stowage of all portable elevator equipment, including portable hatch stanchions and safety chains, and portable MEDEVAC enclosures.

NOTES:
- 1/ Applicable to elevators with flush deck hatches.
- 2/ Applicable to elevators with in-trunk hatches.
- 3/ Applicable to all trunk doors.
- 4/ Applicable to elevators with hatches.
- 5/ Applicable to all elevators.
- 6/ Applicable only if trunk interference interlocks are required (see 3.13.3.1.14).

4.5.8 Slow speed test.

4.5.8.1 Maintenance jog test. The elevator shall be operated through one complete cycle of hoist and lower operation through the full hoisting range at slow (jog) speed with rated load on the platform and the elevator operating in maintenance jog mode. The test shall incorporate a pause between raise and lower operations to ensure the elevator hoist motor low speed operating time does not exceed 10 minutes per hour.

4.5.8.2 Deck jog test. The elevator shall be operated through one complete cycle of hoist and lower operation between each consecutive deck level served at slow (jog) speed with rated load on the platform and the elevator operating in deck jog mode. The test shall incorporate a pause between raise and lower operations to ensure the elevator hoist motor low speed operating time does not exceed 10 minutes per hour.

4.5.9 Dynamic load test. The elevator 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 de-energized while traveling downward at full speed to set the brake. The platform shall travel no more than 3 feet after the hoisting machinery is de-energized. During this test, no part of the equipment shall fail, come adrift, exhibit permanent deformation, or experience degradation of any operating or control function as a result of the test.

4.5.10 Rated load test. The elevator shall be operated through 10 complete cycles of hoist and lower operation through the full hoisting range at rated speed with rated load on the platform. There shall be an 8-second stop at each limit of travel. After 10 cycles, operate through one cycle of hoist and lower, stopping at each level to verify that the platform decelerates from high speed to slow speed and then stops within 0.25 inch of the selected destination deck.

4.5.11 Emergency stop test. Each E-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.

4.5.12 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 hoist motor overtemperature relay and hoist motor overload relay(s) disabled.

4.5.13 Emergency jog test. The operation of the emergency jog up and emergency jog down functions shall be demonstrated with the elevator PLC de-energized.

4.5.14 Manual lowering test. Manual lowering of the platform with rated load through use of the hoist machinery manual brake release shall be demonstrated. The brake shall also be demonstrated to automatically stop and hold the platform with rated load when manual input to manual brake is discontinued during this test.

4.5.15 Hoisting-rope slack rope device test. Three of the four hoist slack rope devices shall be clamped or tied off such that they cannot actuate and the following steps shall be performed:

a. Lower platform to the spring bumpers, verify that remaining hoist slack rope device has actuated, and verify that platform cannot be dispatched in either the up or down direction.

b. Turn BYPASS switch to the SLACK ROPE BYPASS position and verify platform cannot be jogged down.

c. Turn BYPASS switch to the SLACK ROPE BYPASS position and jog elevator back to deck level.

d. Repeat procedure until each hoist slack rope device has been individually tested.

e. Return system to normal condition.

4.5.16 UOT switch test. A temporary extension shall be attached to the existing UOT vane. The temporary vane extension shall extend farther than the distance between the up terminal stop position and the UOT switch. The elevator platform shall be jogged toward the up terminal level. In order to pass the test, the platform shall stop short of the up terminal level and shall not jog up when the BYPASS switch is turned to OVERTRAVEL BYPASS. It shall be possible to jog down when the BYPASS switch is turned to OVERTRAVEL BYPASS.

4.5.17 Closure system test. Each trunk closure shall be tested to verify the following (see table XVI):

TABLE XVI. Closure operational test.

Test	Verification requirement	Notes
Manual doors	Demonstrate door manual operation for each manual door.	Verify for each manually operated door.
Manual doors	Verify door interlock (securing device) functions as specified in 3.13.3.1.12 for each manual door.	Verify for each manually operated door.
Manual doors	Verify door hold-open latches function as specified in 3.3.35.2 for each manual door.	Verify for each manually operated door.
Powered doors	Verify proper operation and sequencing of all powered door operations, including opening/closing, dogging/undogging, latching/unlatching, and ramp operations for each powered door through 10 complete door cycles. Verify proper operation without damage or interference with each other.	Verify for each powered door.
Powered doors	Verify powered door cycle time for each powered door is as specified in 3.3.35.2.	Verify for each powered door.
Powered doors	Verify powered door stopping performance for each powered door is as specified in 3.3.35.2.	Verify for each powered door.
Powered hatches	Verify proper operation and sequencing of all hatch operations, including opening/closing, dogging/undogging, latching/unlatching, moveable guide rail, and ramp operations through 10 complete hatch cycles. Verify operation does not cause these components to damage or interfere with each other.	Verify for each hatch.
Powered hatches	Verify proper sequencing of all hatch operations with platform position and movement.	Verify for each hatch.
Powered hatches	Verify hatch cycle time is as specified in 3.3.35.3.	Verify for each hatch.
Powered hatches	Verify hatch stopping performance is as specified in 3.3.35.3.	Verify for each hatch.
Ramps	Verify all ramps operate in accordance with 3.3.35.4.	
Powered closures	Demonstrate manual operation capability as specified in 3.3.35.5 for each powered trunk closure.	Verify one of each door and hatch type provided.

4.5.18 Reliability. A failure shall be as specified in 6.7.19 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 fff):

a. Test procedure I. The cyclic testing accomplished during the no-load test (see 4.5.7) and during the rated load test (see 4.5.10) without failure shall satisfy the reliability test.

b. Test procedure II. Using the guidance provided in MIL-HDBK-781, the specified MCBF or MTBF requirement shall be demonstrated by the successful completion of a reliability test. The applicable test level and test plan of MIL-HDBK-781 shall be as specified (see 6.2.ggg).

4.5.19 Maintainability. The MTTR requirement (see 3.24.1 or if other than that specified, see 6.2.vv) shall be demonstrated by the successful completion of a maintainability demonstration using the guidance provided in MIL-HDBK-470.

4.5.20 Lighting verification. Light meter readings shall be taken at ten locations around the perimeter of rectangular platforms. The locations are a distance of ⅓ of the platform width from each corner, at the midpoint of each long side, and at ¼ 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 ⅓ 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. The readings at each deck level shall average not less than 7 foot-candles with no reading allowed to be less than 5 foot-candles.

4.5.21 Trunk closure structural and damage control performance. Trunk closures shall be tested for tightness, structural, and damage control performance as specified (see 6.2.hhh).

4.5.22 Wire rope safety factors and hoist wire rope stretch. Analysis and calculations shall be performed to verify safety factors are as specified in 3.4.1 and hoist wire rope stretch is in accordance with 3.8 (see 6.2.iii).

4.5.23 Component safety factors and stress levels. Analysis and calculations shall be performed to verify component safety factors and stress levels are as specified in 3.4.2 (see 6.2.jjj).

4.5.24 System safety. Verification that hazards to personnel and the ordnance or other loads handled by the elevator system have been minimized to an acceptable level of risk (see 3.26) shall be as specified (see 6.2.kkk).

4.5.25 Software verification and validation. All system software (see 3.27) shall be documented, verified, and validated by an independent CMMI Level 3 activity as specified (see 6.2.lll).

4.5.26 Ethernet capability. The capability of monitoring, troubleshooting, adjusting programmable parameters, and uploading or downloading of system software through the Ethernet ports (see 3.27) via a portable computer utilizing the operating system software and Ethernet protocols, as specified (see 6.2 mmm), shall be demonstrated. The function of the Ethernet network ports shall also be demonstrated.

4.5.27 Username and password demonstration. The capability to provide password protection to system settings and operational characteristics as specified in 3.30 shall be demonstrated.

4.5.28 Logging. The ability to store fault data, present operating state, and alarm conditions as specified in 3.31 shall be demonstrated.

4.6 Prohibited materials. Prohibited materials shall be verified as specified (see 3.2.14 and 6.2.e).

4.7 Rejection. Failure to pass any of the examinations or tests specified in section 4 in its entirety shall be cause for rejection.

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

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The intent of this specification is to ensure the safe, reliable operation of a naval shipboard elevator for the purpose of transporting weapons, cargo, or personnel in a MEDEVAC operation.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Elevator classification (see 1.2).

c. Elevator Logic Control Method (see 1.2 and 3.13.1.3).

d. When first article is required (see 3.1 and 6.4).

e. Requirement for prohibited materials verification (see 3.2.14 and 4.6).

f. Storm sea conditions and loading factors (see 3.3.2, 3.3.8, 3.7, and 6.7.18).

g. Moderate sea conditions and loading factors (see 3.3.3, 3.5.2.3, 3.5.3.5, 6.3, and 6.7.11).

h. Shock grade (see 3.3.25, 3.13.3.16, and 4.2.6).

i. Explosion-proof equipment requirements (see 3.3.27 and 3.12.1.2).

j. Noise limit (see 3.3.29).

k. Levels served (see 3.3.33, 6.7.7, and 6.7.17).

l. Direction of platform loading (see 3.3.33, 3.5.2.2, and 6.7.9).

m. Mobile handling equipment (see 3.3.33, 3.3.35.4, 3.5.2.2, 3.5.2.3, 3.5.3.4, and B.2.1.6).

n. Trunk strength and tightness (see 3.3.34).

o. Location, size, and type of each trunk closure and operating system (see 3.3.35 and 3.6.3).

p. Damage control requirements for each trunk closure (see 3.3.35.1).

q. Flush deck hatch wheel loads (see 3.3.35.1).

r. Operation of trunk doors and their associated dogging mechanisms and securing devices (see 3.3.35.2).

s. Door cycle time (see 3.3.35.2).

t. Operation of flush deck hatches, in-trunk hatches and associated dogging mechanisms, securing devices, and hinged guide rails, if other than hydraulic power (see 3.3.35.3).

u. Flush deck hatch cycle time (see 3.3.35.3).

v. Ramp cycle time (see 3.3.35.4).

w. Trunk closure security requirements, if different from this specification (see 3.3.36).

x. Platform rated load capacity (see 3.5.2.1, 3.11.1, 6.7.11, 6.7.15, and 6.7.18).

y. Possible rated load footprints on platform (see 3.5.2.2 and 3.5.2.3).

z. Anticipated payload shapes (see 3.5.3.4 and 6.7.13).

aa. Securing of anticipated elevator payloads (see 3.5.3.4 and 6.7.13).

bb. Platform deck fitting requirements (see 3.5.3.5).

cc. Personnel fall arrest lanyard anchorage requirements (see 3.5.3.6).

dd. Platform liferail requirements (see 3.5.3.7).

ee. Platform Emergency MEDEVAC enclosure requirements (see 3.5.3.8 and 3.15.1).

ff. Broken rope safety device waiver (see 3.6.2 and 6.3).

gg. Requirements for electrical enclosures, if other than specified (see 3.12.1.2).

hh. Motor control system (two-speed or variable speed drive; see 3.13.1).

ii. Network communication protocol requirements for control, if other than specified (see 3.13.1.2, 3.13.1.3.2, and 3.13.1.12).

jj. Compatibility with connected external portable computer (see 3.13.1.2, 3.13.1.3.2, 3.13.1.12, table X, table XI, and table XII).

kk. Location of master control station (see 3.13.1.6).

ll. Locations requiring recessed control stations (see 3.13.1.9).

mm. Location of hatch sequence level (see 3.13.3.1.3, 3.13.3.1.4, 3.13.3.1.10, 3.13.3.1.11, and 3.13.3.4).

nn. Waiver to permit doors at same level, serving same compartment to be open at same time (see 3.13.3.1.12).

oo. Platform stow (parking) level (see 3.13.3.1.17).

pp. Touchscreen HMI to PLC communication protocol (see 3.13.3.17).

qq. Drift jog capability (see 3.13.3.19).

rr. Emergency MEDEVAC voice communication requirements (see 3.15.1).

ss. Powered closure system requirements, if other than specified (see 3.16).

tt. Hatch stanchion, deck socket, and chain lifeline assembly requirements, if other than specified (see 3.17).

uu. Darken ship requirement (see 3.18 and 3.19).

vv. MTTR, if different from 8 hours (see 3.24.1 and 4.5.19).

ww. System safety requirements (see 3.26).

xx. Operating system and communication protocols (see 3.27).

yy. Additional software requirements (see 3.27).

zz. Requirement to provide all software via compact disk (CD) (see 3.27).

aaa. First article inspection requirements (see 4.2).

bbb. Hoist machinery (see 4.2.3).

ccc. Conformance inspection requirements (see 4.3).

ddd. Requirement for a test plan (see 4.5.1).

eee. Certification for test weights ensuring they are the proper load (see 4.5.2).

fff. Reliability test procedures (see 4.5.18).

ggg. Applicable test level and test plan of MIL-HDBK-781 (see 4.5.18).

hhh. Testing of trunk closures for tightness, structural, and damage control performance (see 4.5.21).

iii. Wire rope stretch in accordance with requirements (see 4.5.22).

jjj. Component safety factors and stress levels in accordance with requirements (see 4.5.23).

kkk. System safety (see 4.5.24).

lll. Software verification and validation (see 4.5.25).

mmm. Ethernet capabilities (see 4.5.26).

nnn. Controls used for testing (see 4.8).

ooo. Packaging requirements (see 5.1).

ppp. Submission of equipment or system technical manual (see 6.5).

qqq. Engineering technical data package content (see Appendix A).

rrr. Engineering design data and calculation content (see Appendix B).

6.3 Broken rope safety device waiver. The broken rope safety device requirements may be waived only when wedging analysis, including drawings and calculations, is developed and demonstrates the following with moderate sea load factors (see 6.2.g) applied:

a. The elevator platform with rated load will wedge in trunk when all ropes on one end or one side of the platform break.

b. Securing fittings on the platform are of sufficient strength to prevent the rated load from coming adrift when the platform wedges.

c. For elevators having in-trunk hatches, the wedging action arrests downward movement of the platform with rated load at the rated speed.

d. For elevators that do not have in-trunk hatches, the wedging action arrests downward movement of the platform with rated load.

6.4 First article. When first article inspection is required (see 6.2.d), the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction 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 provide for the Government to reserve the right to witness testing. The contracting officer should also include specific 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 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract (see 6.2.ppp). If technical manuals are required, they must be acquired under separate contract line items.

6.6 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.

6.7 Definitions.

6.7.1 Cybersecurity. Prevention of damage to, protection of, and restoration of computers, electronic communication systems, electronic communication services, wire communication, and electronic communication, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and non-repudiation.

6.7.2 Dead-man operation. The requirement for continuous positive human operator input in order to initiate and maintain switch output.

6.7.3 Door position. Overhead and vertically sliding up to open doors are considered fully open when the door is up, latched, and the ramp extended (if applicable) and fully closed when it is down, dogged, and ramp retracted (if applicable). Horizontal rolling and hinged doors are considered fully open when they have engaged the open stops and ramps extended (if applicable) and fully closed when closed, dogged, and ramps retracted (if applicable).

6.7.4 Emergency medical evacuation (MEDEVAC). As used in this specification, this term refers to the process of transporting sick or injured litter-borne personnel by an elevator that has been specially equipped for this purpose.

6.7.5 Fail-safe operation. The ability to maintain the safety of the load (weapon, cargo, etc.), equipment, and personnel at all times.

6.7.6 Hatch position. Flush deck hatches are considered fully open when the hatch is open against the stops, latched, and the ramp(s) extended and fully closed when it is down, dogged, and ramp(s) retracted. In-trunk hatches are considered fully open when it has engaged the open stops and sectional guide rails extended (if applicable) and fully closed when closed, dogged, and rails retracted (if applicable).

6.7.7 Hatch sequence level. A designated level for elevators having flush deck and in-trunk hatches (see 6.2.mm). The hatch sequence level is the level above which the control system should not permit the platform to travel upward unless the flush deck hatch is secured in the fully open position and hatch ramps are positioned to allow the platform to safely approach the flush deck hatch level. The hatch sequence level is also the level below which the control system will not permit the platform to travel downward unless the in-trunk hatch is secured in the fully open position and hinged guide rails are in the correct position for the platform to safely traverse them. In some cases, the hatch sequence level may also serve as the STOW level.

6.7.8 In-trunk hatch. A horizontally mounted hatch covering the lower section of the elevator shaft.

6.7.9 Loading design load. An equivalent load equal to the rated load plus the elevator platform weight, plus the maximum 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. For applicable handling equipment interface data, platform loading scenarios, and ship motion data, see 6.2.

6.7.10 Lower terminal level. The lower–most level served by the elevator.

6.7.11 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.g), plus the load due to acceleration or deceleration of the elevator.

6.7.12 Parking level. The level to which the platform is dispatched when commanded to stow for elevators with either one flush hatch or no hatches at all.

6.7.13 Platform safe loading area. The contiguous area of the platform working deck within which specified payloads (see 6.2.z) are positioned and secured to the platform deck for transport and which does not overlap the platform safety margin (see 3.21.3).

6.7.14 Project file. Term used to represent software used to provide operation of programmable equipment.

6.7.15 Rated load. Maximum load specified to be lifted by the elevator platform (see 6.2.x), including the combination of:

a. Cargo, weapons, ordnance, stores, materials, or equipment load (including handling attachments, packaging, or securing equipment transported with these loads).

b. Any additional equipment or materials to be lifted which are not integral with the load (including packaging, securing devices, handling attachments, and mobile or portable handling equipment).

6.7.16 Special tools. Those tools not listed in the GSA Global Supply Catalog (copies of this catalog may be consulted in the office of the Defense Contract Management Agency [DCMA] or viewed online at https://www.gsaglobalsupply.gsa.gov/).

6.7.17 Stow level. The level at which the elevator platform is positioned for stowage when the elevator system is not in use (see 6.2.oo).

6.7.18 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.x), with the elevator in the stowed condition.

6.7.19 System failure. Any event that necessitates corrective maintenance. Chargeable failures include any major or minor failures attributable to the internal operation of the system and system components. Failures due to external sources or operator error do not constitute chargeable failures.

6.7.20 Technical Authority. The Technical Authority has the authority, responsibility, and accountability to establish, monitor, and approve technical standards, tools, and processes in conformance to higher authority policy, requirements, architectures, and standards. NAVSEA 05S may be contacted to determine the appropriate Technical Authority for any given requirement related to equipment and systems of U.S. Navy ships and submarines.

6.7.21 Upper terminal level. The upper most level served by the elevator.

6.8 Subject term (key word) listing.

Ammunition handling
Cargo handling
Control station
Controller
Cybersecurity
Emergency MEDEVAC
Hoist machinery
Intraship handling
Material handling
Ordnance handling
Platform
Strike down
Strike up
Stores handling
Transport
Trunk
Underway replenishment (UNREP)
Weapons handling
Wire rope

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

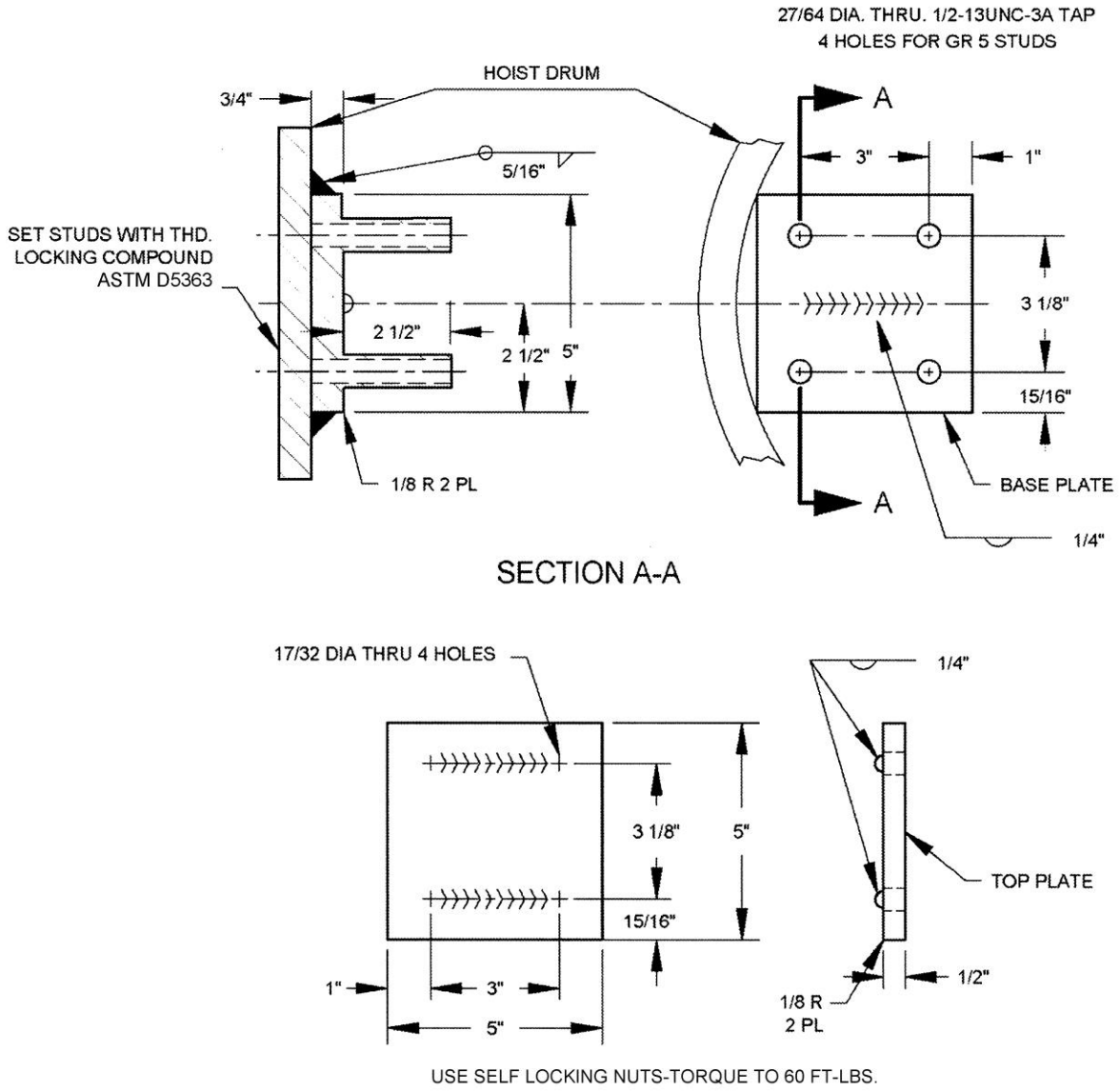
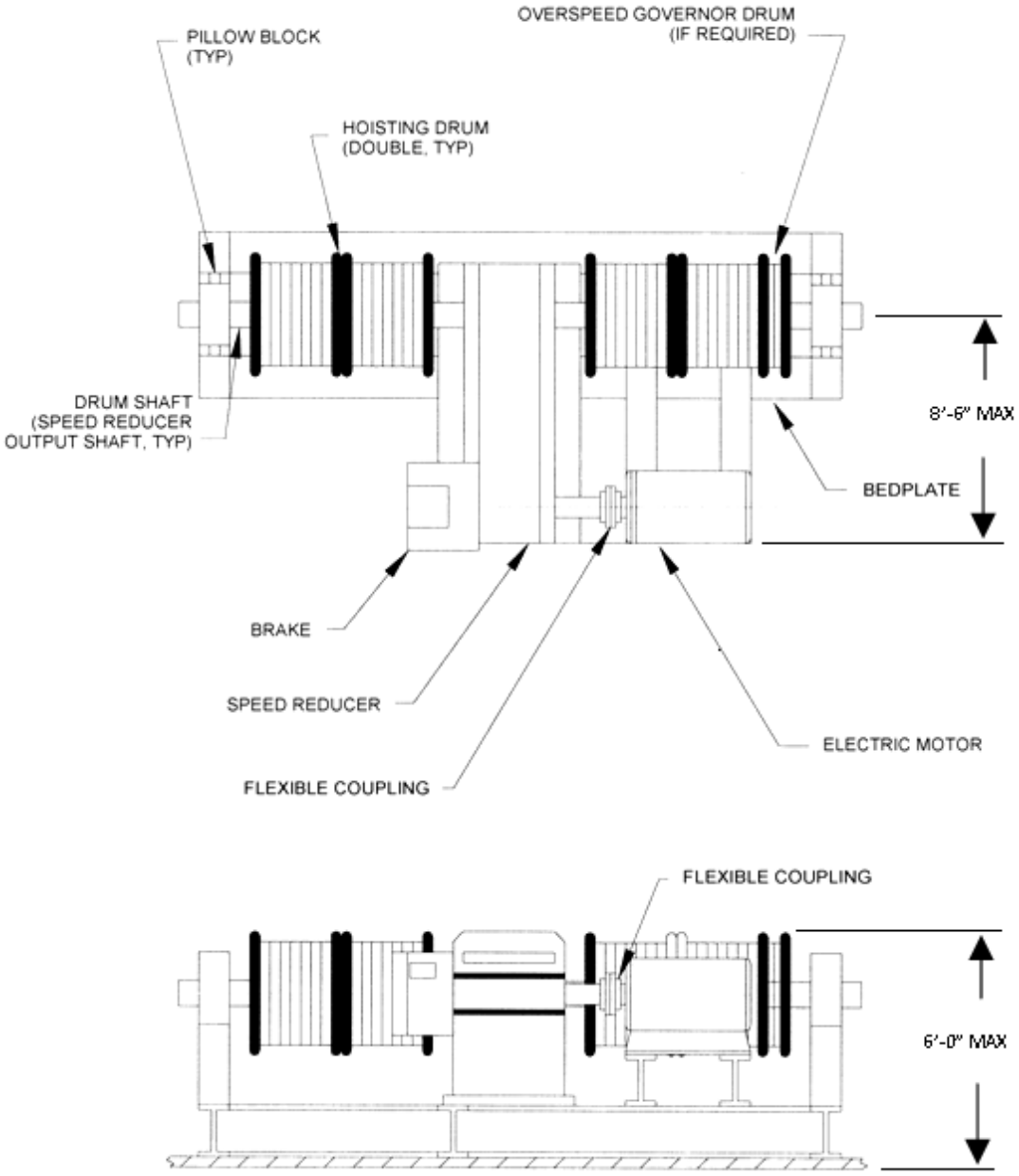
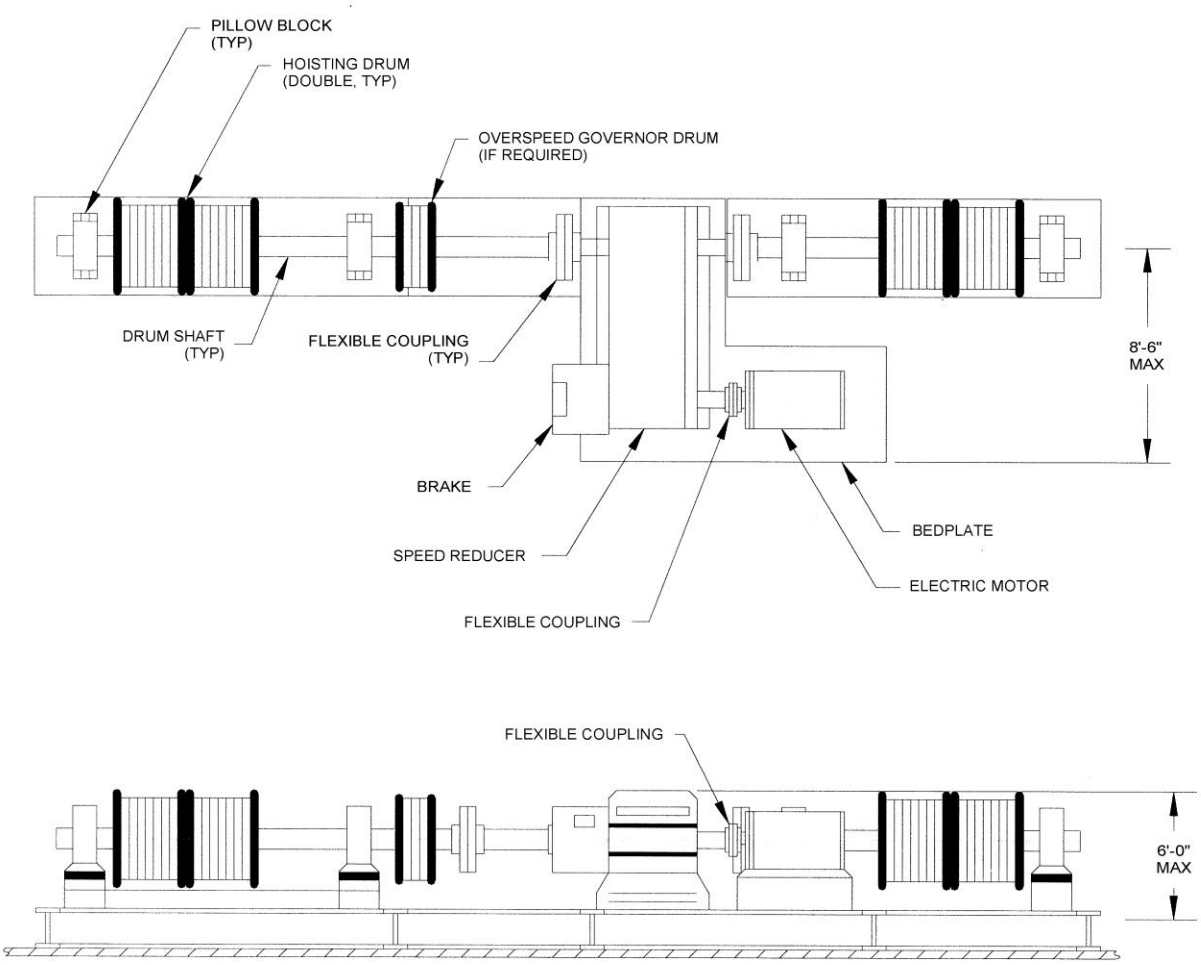


FIGURE 1. Wire rope clamp for hoist drum.



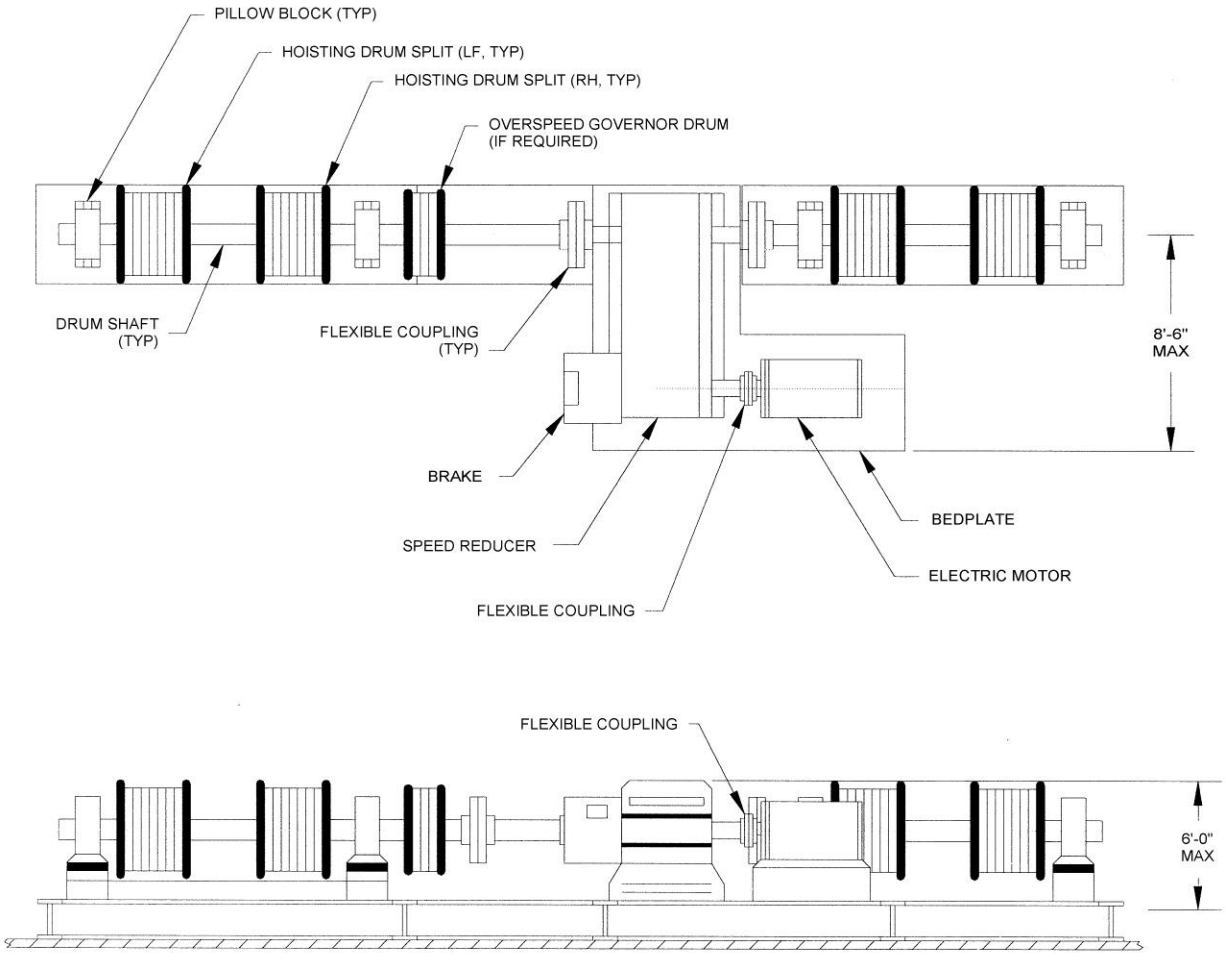
NOTE: Double drums; drums mounted on speed reducer output shaft; machinery guard not shown for clarity.

FIGURE 2. Elevator hoist machinery arrangement (option 1).



NOTE: Double drums; drums mounted separate from speed reducer; machinery guard not shown for clarity.

FIGURE 3. Elevator hoist machinery arrangement (option 2).



NOTE: Split drums; drums mounted separate from speed reducer; machinery guard not shown for clarity.

FIGURE 4. Elevator hoist machinery arrangement (option 3).

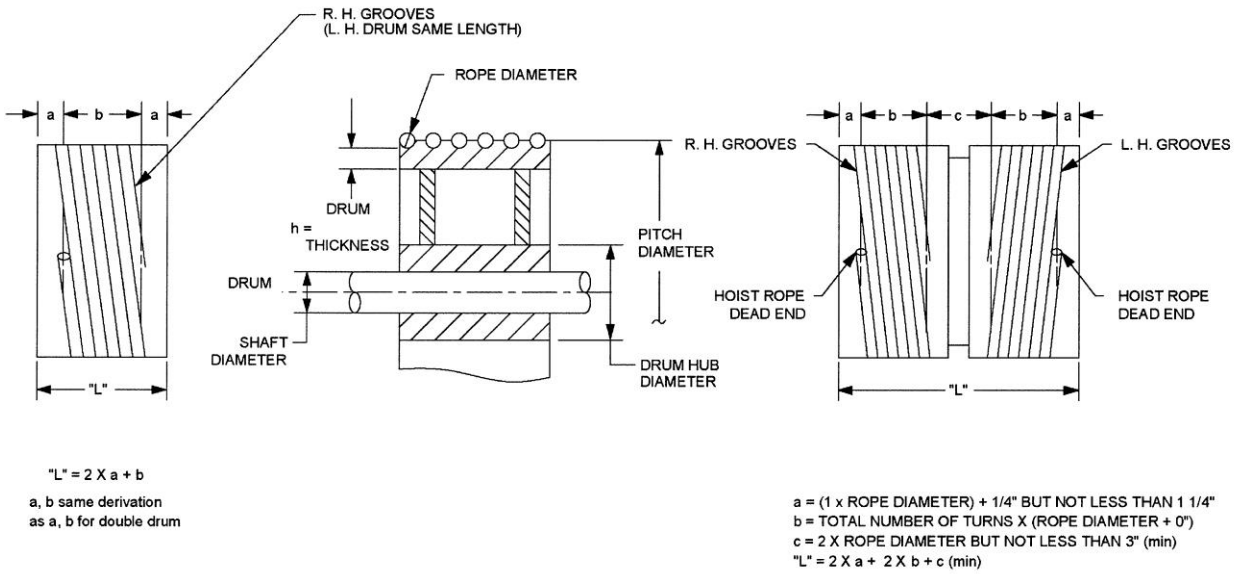
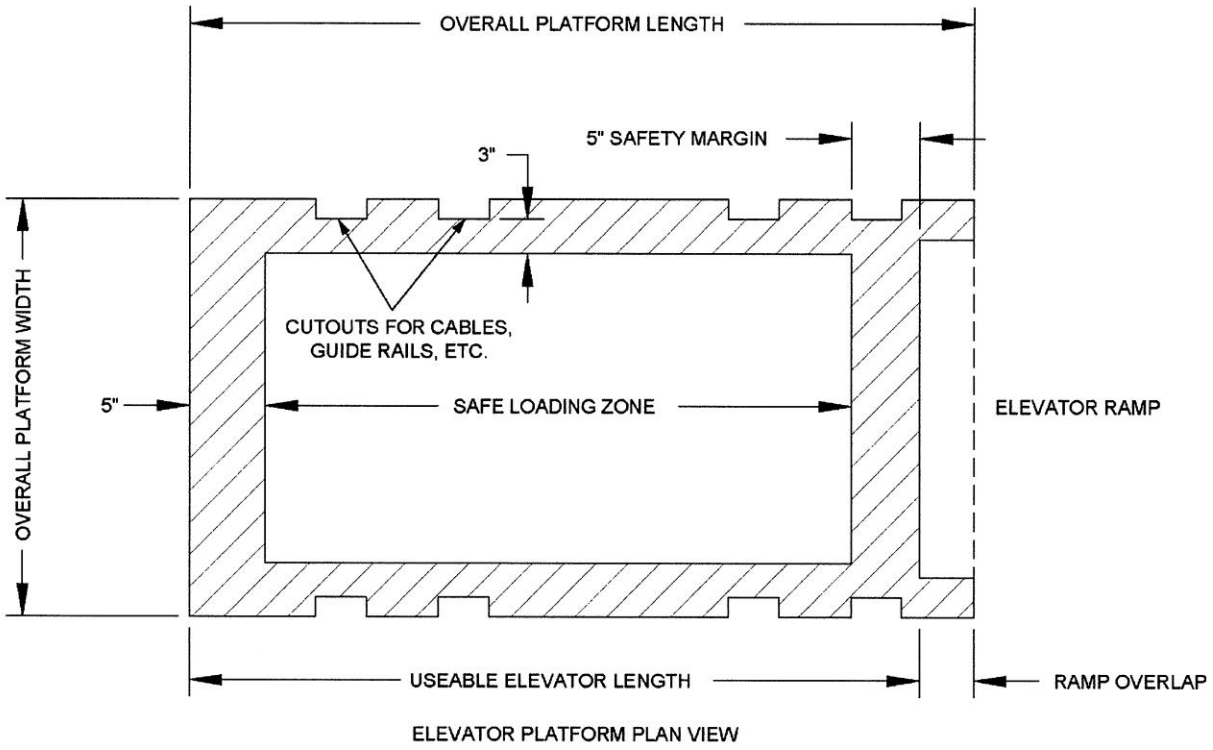


FIGURE 5. Hoist drum dimensions.



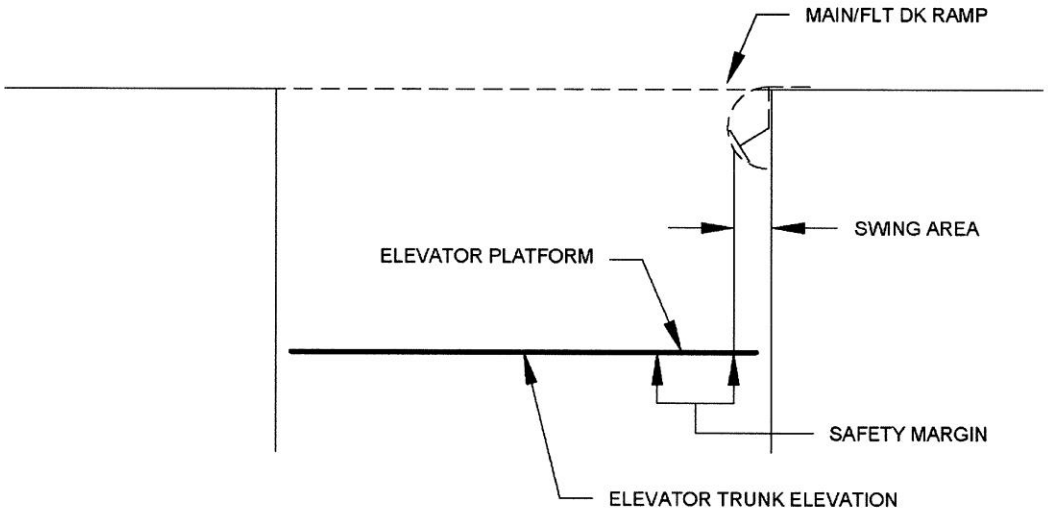


FIGURE 6. Elevator platform safety margin.

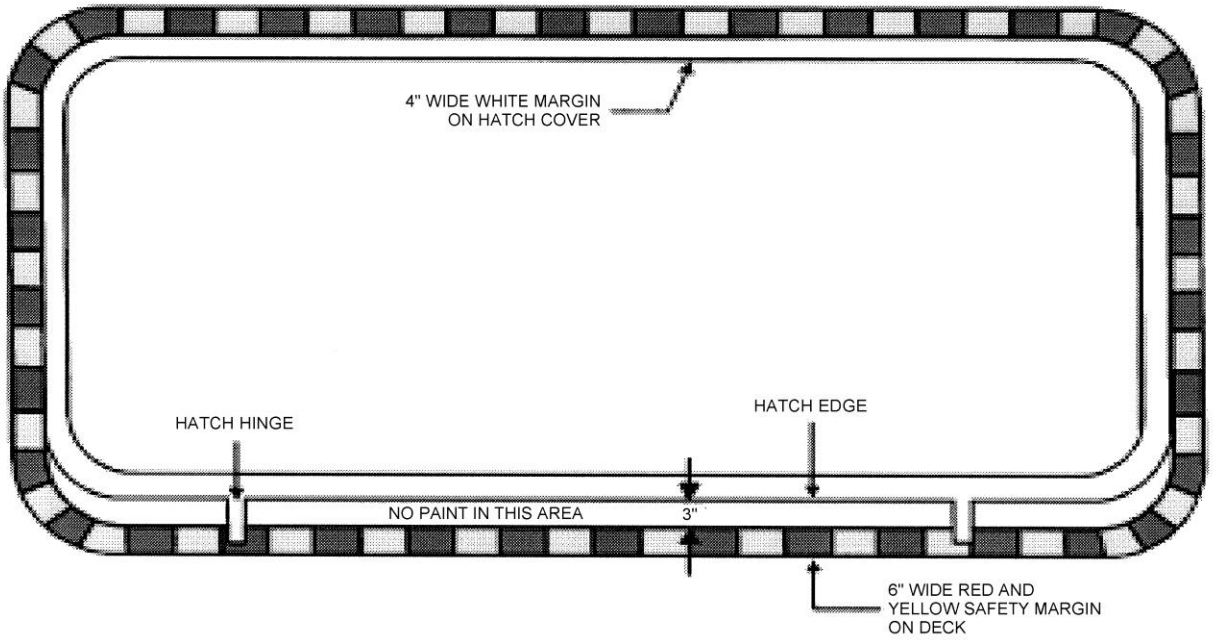


FIGURE 7. Elevator flush deck hatch safety markings.

ENGINEERING DRAWINGS TECHNICAL CONTENT

A.1 SCOPE

A.1.1 Scope. This Appendix covers engineering drawing content that should be considered for specification in the contract or order (see 6.2.qqq). This Appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

A.2 DRAWING CONTENTS

A.2.1 Drawing contents. Drawings and associated lists should contain sufficient information for design evaluation and procurement of substantially identical items without additional design effort. The following technical information should be included in the drawings and associated lists:

a. An isometric key plan of the elevator depicting its location and arrangement or the elevator trunk, machinery room, control stations, and all trunk closures.

b. General arrangement drawings of the complete elevator system. The general arrangement drawing should include all views, sections, and details as necessary to depict the location and arrangement of elevator system equipment within the ship.

c. Assembly and details, including overall dimensions, weight, center of gravity, operator controls, and applicable operating and maintenance access clearances (if any) for the following major components:

(1) Hoist machinery assembly

(2) Platform assembly

(3) All control station assemblies

(4) All motor controller or motor drive assemblies

(5) All logic controller assemblies

(6) Emergency MEDEVAC enclosure (if any)

(7) Hydraulic power units (if any)

(8) Fluid tanks (if any, if separate from hydraulic power unit)

(9) Each type and size elevator trunk closure and associated operating machinery

d. Assembly and details of elevator hoist wire rope and overspeed governor wire rope reeving arrangement.

e. Elevator cabling diagrams.

f. Elevator interconnecting wiring diagrams, connection tables and schematic diagrams for all safety, logic, motor control, and brake control circuits.

g. Ladder logic diagrams for all programmable logic.

h. List of material listing all elevator system parts. Information identifying each part should include a brief description, unit weight, quantity required, manufacturer, manufacturer's part number, National Stock Number, and applicable specification.

i. Elevator powered closure system schematic, cabling, and piping diagrams.

j. Description of operation of the control system.

k. Description of adjustments, including programmable adjustments, that can be made on the equipment.

l. Arrangement of all platform actuated proximity switches and limit switches and corresponding platform mounted cams or vanes. If the laser sensor is utilized, include the platform mounted reflective target and the laser foundation.

m. A diagram or chart disclosing estimated travel times and distances for each possible dispatch cycle. Powered door and hatch cycle times should be included and identified in these cycle charts. The diagrams or charts should identify the platform position at which each platform actuated limit switch and proximity switch is actuated by the platform. If the laser sensor is utilized, the laser slow and stop distances should also be computed.

n. A table of repair parts and special tools.

o. A table of labels, warning, cautions, and instruction plates.

p. Specific installation instructions for equipment being supplied. This includes machinery and guide rail alignment, grounding, shielding, cable routing, acceptable types and sizes of cabling, and so forth.

q. Where materials of identical or equal characteristics can be identified by more than one specification or standard, the drawings should 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

DESIGN DATA AND CALCULATIONS TECHNICAL CONTENT

B.1 SCOPE

B.1.1 Scope. This Appendix covers design data and calculations that should be considered for specification in the contract or order (see 6.2 rrr). This Appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

B.2 DESIGN DATA AND CALCULATIONS TECHNICAL CONTENTS

B.2.1 Design data and calculations technical content. Design data and calculations should include the following:

B.2.1.1 Hoist machinery calculations. Calculations should be prepared to justify the size of the motor, speed reducer, couplings, bearings, brake, and shafting to verify compliance with the stress limits specified in 3.4.2. Calculations should consider loading conditions, fatigue, stress concentrations, and the type of stress.

B.2.1.2 Motor drive calculations. Calculations should be prepared to justify the size of all electric motors and motor drives used.

B.2.1.3 Hoist wire rope calculations. Calculations should be prepared to justify the size of the hoist wire ropes to ensure ropes are in compliance with the stress and stretch limits specified in 3.4.2. Calculations should consider fatigue, loading conditions, and hoist rope reeving arrangements.

B.2.1.4 Platform wedging analysis. An analysis should be prepared to justify omission of broken rope safety devices as specified in 3.6.2 and 6.3. Calculations should consider strength, arrangement, and loading of the platform, guide shoes, and guide rails. Wedging analysis should include diagrams showing the platform wedging contact point locations and the direction and magnitude of the associated wedging forces.

B.2.1.5 Closure system machinery calculations. Calculations should be prepared to justify the size of the hydraulic power unit and associated fluid storage, actuators, and energy storage. Calculations should consider loading conditions and duty cycle requirements.

B.2.1.6 Platform loading analysis. An analysis should be prepared to verify the capability of the elevator to be loaded and unloaded at each level served, using the handling equipment specified (see 6.2 m). The diagrams should additionally verify the capability to positioning and transporting the specified loads (see 6.2.z) within the platform safety margin.

B.2.2 System weight estimate. Calculations should be prepared to disclose the estimated system weight in order to assess ship weight and stability impact. Weight calculations should show the weight of the complete system broken down as follows:

a. Weight of elevator equipment in machinery room
   (1) Hoist machinery
   (2) Controls
   (3) Ropes and sheaves
   (4) Other elevator equipment in machinery room
b. Weight of elevator equipment in or on trunk
   (1) Sheaves
   (2) Guide rails
   (3) Platform
   (4) Closure system equipment
   (5) Other elevator equipment in or on trunk

c. Weight of any elevator equipment not included in B.2.2.a and B.2.2.b above

(1) Controls

(2) Machinery

(3) Other

B.2.3 Powering requirements calculations. Calculations should be prepared to disclose electric power requirements of the elevator system (including powered closures) in order to assess impact on ships' distributed systems. The electric power requirements for both static readiness condition (elevator system energized but machinery not running under load), operation with rated load at the specified duty cycle condition (see 3.11.6), and dynamic load test (see 4.2.3.3) should be calculated. Calculations for duty cycle condition should include powering requirements for the operation of powered closures. Calculations should show maximum current, steady state current, and power consumption in kilowatt-hours for each condition. Calculation of hoist machinery overload protection settings should also be included.

B.2.4 Force calculations and diagrams. Calculations and diagrams should be prepared to disclose the location, magnitude, and direction of the following forces in order to assess impact on ships structure:

a. Maximum estimated vertical forces acting on guide rail supports when platform safety linkage is actuated with rated load on platform and platform traveling downward at the overspeed governor trip speed.

b. Maximum estimated forces on guide rail supports when platform contacts guide rail fixed stops while traveling upward at the rated speed with no load.

c. Maximum estimated horizontal forces acting on the guide rail supports during platform loading and unloading operations.

d. Maximum estimated impact load on buffer supports when contacted by platform traveling downward at the rated speed with rated load.

e. Maximum estimated forces imparted on ship's structure by hoist machinery, hoist sheaves, and associated hoist rope tensions.

B.2.5 Heat load calculations. Calculations should be prepared to disclose location (compartment) and magnitude of thermal energy emitted by the following elevator equipment in under conditions or operation with rated load at the specified duty cycle (see 3.11.6) and idle (system in normal readiness state, no machinery operating):

a. Hoist machinery

b. Hoist machinery motor controller or drive

c. Elevator Hybrid Relay Logic Controller or PLC

d. Hydraulic power unit

e. Elevator control stations

INADVERTENT OPERATIONS TEST SCENARIOS

C.1 SCOPE

C.1.1 Scope. Inadvertent operations encompasses operational scenarios that may occur in the event of operator error or failure of a system component. It shall serve as a supplement to all operations detailed in the main body of this specification. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

C.2 SETUP

C.2.1 Program/hardware interlock. PLC programs shall have embedded interlocks to prevent elevator operation if the program loaded in the processor is not for that specific elevator.

C.2.2 Network communication. With the exception of emergency jog, platform movement shall terminate immediately if any PLC communication module or I/O module fails, is physically removed, or if the interconnecting network is disrupted or signals lost. For elevator systems that have the capability to open powered doors using networked door controls, door operation shall terminate immediately if network communications between the door controls and the PLC processor are lost. For elevator systems that use remote I/O for hatch input and output signals, hatch operation shall terminate immediately if network communications are lost.

C.3 JOG MODE

C.3.1 Interlocked jog pushbuttons. For elevator systems where jog capabilities are located at more than one location, all JOG UP and JOG DOWN controls shall be interlocked so that only one jog command can execute at a time from any location.

C.4 DISPATCH OPERATION

C.4.1 Safety interlock. Dispatch operation shall not be permissible if a slack rope or overspeed governor condition is present.

C.4.2 Master/secondary control stations. For elevator systems that have a secondary control station, it shall not be possible to dispatch the platform to the deck level served by the master control station if the CONTROL STATION SELECT switch does not have control set to MASTER CONTROL STATION.

C.4.3 Hatch interlock. Platform movement shall terminate immediately upon unexpected actuation or de-actuation of any hatch switch.

C.4.4 Hatch sequence. For dual hatch elevator systems, it shall not be permissible to dispatch the platform if either hatch is not fully closed.

C.4.5 Door dog interlock. Platform movement shall terminate immediately if any door is not fully closed.

C.4.6 Hatch cycle time interlock. For dual hatch elevator systems, a dispatch command requiring the cycling of a hatch shall terminate after 1 minute if that hatch fails to fully sequence to the expected position.

C.4.7 Platform direction. Platform movement shall terminate immediately if movement occurs in a direction other than that expected.

C.4.8 Door/hatch interlock. Hatch operation shall terminate immediately if any door is no longer in the fully closed position.

C.4.9 Hatch fully open or closed. For elevator systems with hatches, all switches in the hatch open configuration shall be actuated and all switches in the hatch closed configuration shall be de-actuated for the hatch to be fully sequenced in the fully open position. All switches in the hatch closed configuration shall be actuated and all switches in the hatch open configuration shall be de-actuated for the hatch to be fully sequenced in the fully closed position.

C.4.10 Slow switch interlock. If the platform fails to actuate the destination deck level slow switch, the platform shall shift to slow speed when the next switch is actuated and stop on the subsequent switch (including UTL/DTL as applicable). There is no analogous inadvertent failure mode for the laser sensor; if the PLC does not receive distance input from the laser, the PLC Ready and PLC SIR shall fault and terminate the command. If that safety were to also fail, then the UOT switch or SLACK ROPE switches shall fault the SIR 115 and PLC SIR circuits.

C.4.11 Stop switch interlock. If the platform fails to actuate the destination deck level stop switch, the platform shall continue at slow speed and stop when the next switch is actuated (including UTL/DTL as applicable). There is no analogous inadvertent failure mode for the laser sensor; if the PLC does not receive distance input from the laser, the PLC Ready and PLC SIR shall fault and terminate the command. If that safety were to also fail, then the UOT switch or SLACK ROPE switches shall fault the SIR 115 and PLC SIR circuits.

C.4.12 In-trunk ramp interlock. For elevator systems that have door ramps located on the inside of the elevator trunk, platform movement shall terminate immediately if any in-trunk ramp retracted switch fails to remain actuated.

C.4.13 Laser positioner interlock. If at any time the laser position signal is lost to the PLC, the platform movement shall be stopped immediately. Dispatch or Jog commands (except emergency jog) shall not be executed if the PLC does not receive a laser position input.

C.5 STOW/UNSTOW/E-STOW OPERATIONS.

C.5.1 Emergency stow sequence for dual hatch elevators. Initiation of E-STOW shall be capable of overriding the following conditions:

a. If an E-STOW command is initiated while both hatches are open, the platform shall travel down to the hatch sequence level and both hatches shall fully close and execute the remainder of the E-STOW operation.

b. If an E-STOW command is initiated while the platform is moving in the up direction from the hatch sequence level, the platform shall immediately terminate the previously initiated command and remain stopped for 2 seconds before executing the remainder of the E-STOW operation.

c. If an E-STOW command is initiated while the platform is located between the flush deck hatch level and the hatch sequence level, the platform shall travel down to the hatch sequence level and execute the remainder of the E-STOW operation.

d. If the platform fails to actuate the hatch sequence level stop switch when an E-STOW is initiated, the platform shall stop when the DTL switch is actuated, all open hatches shall fully close and execute the remainder of the E-STOW operation.

e. If the platform fails to actuate the hatch sequence level slow switch when an E-STOW is initiated, the platform shall shift to slow speed when the hatch sequence level stop switch is actuated and stop when the DTL switch is actuated, and all open hatches shall fully close and execute the remainder of the E-STOW operation.

f. If the platform fails to actuate the hatch sequence level slow and stop switches when an E-STOW is initiated while both hatches are open, the platform shall shift to slow speed when the DTL switch is actuated and stop at the next deck level, where only the flush deck hatch shall fully close.

g. If an E-STOW command is initiated while the platform is located below the hatch sequence level and both hatches are open, the platform shall travel down and stop at the next deck level, where only the flush deck hatch shall fully close.

h. An E-STOW command shall terminate after 5 minutes if either hatch fails to fully close.

i. If an in-trunk ramp is extended at any level in the path of the platform when an E-STOW command is initiated, the ramp shall first be commanded to retract and the platform shall dispatch, and the elevator shall complete hatch closure and execute the remainder of the E-STOW operation.

C.5.2 Emergency stow sequence for single hatch elevators. Initiation of E-STOW shall be capable of overriding the following conditions:

a. If an E-STOW command is initiated while the platform is moving in the up direction, the platform shall immediately terminate the previously initiated command and remain stopped for 2 seconds before executing the E-STOW operation to stow the platform at the parking level and execute the remainder of the E-STOW operation.

b. If an E-STOW command is initiated while the platform is located between the flush deck hatch level and the parking level, the platform shall travel down to the parking level and execute the remainder of the E-STOW operation.

c. If the platform fails to actuate the parking level stop switch when an E-STOW command is initiated, the platform shall stop when the next level switch in the down direction is actuated, and the hatch shall fully close and execute the remainder of the E-STOW operation.

d. If the platform fails to actuate the parking level slow switch when an E-STOW command is initiated, the platform shall shift to slow speed when the parking level stop switch is actuated and stop when the next level switch in the down direction is actuated, and the hatch shall fully close and execute the remainder of the E-STOW operation.

e. If the platform fails to actuate the parking level slow and stop switches when an E-STOW command is initiated while the hatch is open, the platform shall slow and stop at the next deck level, and the hatch shall fully close and execute the remainder of the E-STOW operation.

f. If an E-STOW command is initiated while the platform is located below the parking level and the hatch is open, the platform shall travel down and stop at the next deck level, and the hatch shall fully close and execute the remainder of the E-STOW operation.

g. An E-STOW command shall terminate after 5 minutes if the hatch fails to fully close.

i. If an in-trunk ramp is extended at any level in the path of the platform when an E-STOW command is initiated, the ramp shall first be commanded to retract and the platform shall dispatch, and the elevator shall complete hatch closure and execute the remainder of the E-STOW operation.

C.5.3 Stow sequence for any elevator. Initiation of a STOW command shall only be permissible if hatch(es) are in normal configuration and only if the SIR 115 and PLC SIR circuits are run permissive.

C.5.4 Unstow interlock. An UNSTOW command shall not be permissible if one or multiple hatches are not fully closed.

C.5.5 Safety interlock. STOW, UNSTOW, and E-STOW commands shall not be permissible if a Slack Rope or Overspeed Governor condition is present.

C.6 BYPASS MODE

C.6.1 Bypass interlock. DISPATCH, STOW, UNSTOW, and E-STOW commands shall not be permissible if Jog Mode, UOT/UTL Bypass Mode, or Slack Rope DTL Bypass Mode is enabled.

CONCLUDING MATERIAL

Preparing activity:
Navy – SH
(Project 20GP-2018-001)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.