DEPARTMENT OF THE NAVY
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IN REPLY REFER TO
11300
CI46/LRP
1 August 2013

From: Commander, Naval Facilities Engineering Command

Subj: INTERIM TECHNICAL GUIDANCE (ITG 2013-01) - ELEVATOR DESIGN

Ref: (a) ITG 01-01 INTERIM TECHNICAL GUIDANCE (ITG) "ELEVATOR DESIGN GUIDE" dated 01 March 2001

Encl: (1) ITG 2013-01 - NAVFAC ELEVATOR DESIGN dated 1 August 2013

1. Purpose. The enclosure provides interim technical guidance for the design of elevators, including the coordination of efforts among multiple design disciplines.

2. Background. Elevators are required to be provided in Navy Facilities for compliance with statutes, regulations, codes, Navy criteria, and facility operational requirements. The current requirements in reference (a) are outdated and have driven multiple modifications for several years. The latest version identifies uniform methods to be used to comply with current OSHA, Building, and Safety Code requirements; provides energy efficient design improvements; and allows more effective sustainability of elevator systems. Enclosure (1) is provided to document current elevator requirements until a Unified Facilities Criteria document is completed and issued.

Specific changes in this document from the previous version include:

a) Update of all referenced Codes and Standards.
b) Design for Confined Space egress area in elevator hoistway.
c) Expansion of Code requirements for medical gurney transport sizing.
d) Addition of battery powered lowering devices on hydraulic elevator applications.

The NAVFAC Criteria Office will oversee all future elevator criteria changes as appropriate and will continue to coordinate the development of an Elevator Design Unified Facilities Criteria document to take the place of this ITG. This ITG is available on the Whole Building Design Guide at http://www.wbdg.org/ccb/browse_cat.php?o=30&c=212 .

3. Actions. Reference (a) is superseded by this document. Design all new, replacement, and modernization projects using this document. Revise all projects under design, but not completed, to comply with the guidance where funds and schedule permit.

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4. Points of Contact. For clarification or additional information related to this subject, the following points of contact are provided:

1) NAVFAC Elevator Program Manager - Mr. Kevin Morse, DSN 262-4653, commercial (757) 322-4653, or e-mail kevin.p.morse@navy.mil.

2) NAVFAC Criteria - Mr. Emil Consolacion, P.E., DSN 262-4205, commercial (757) 322-4205, or e-mail emil.consolacion@navy.mil.

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Interim Technical Guidance
ITG 2013-01

NAVFAC ELEVATOR DESIGN GUIDE

01 August 2013

CONTENTS

CHAPTER 1

INTRODUCTION

1-1 Purpose.

Elevator installations are complex, multi-disciplined systems that interface with many aspects of the facility design. Design considerations require coordination with architectural, structural, mechanical, electrical, and fire protection disciplines. This document provides direction for the development of project request for proposal (RFP), design, and specification documents related to the procurement and modernization of elevator systems for Navy and Marine Corps Facilities, herein referred to collectively as Navy Facilities.

ASME A17.1, Safety Code for Elevators and Escalators, International Building Code, and other non-governmental safety standards identify minimum design requirements for elevators and for building systems that interface with the elevator controls. The performance language used in the codes and standards results in many different, and often conflicting, interpretations by the hundreds of federal, state, and municipality "Authorities Having Jurisdiction" (AHJ) across the country and around the world.

NAVFAC is the AHJ for Elevators in Navy Facilities. The NAVFAC Elevator Subject Matter Expert (SME) manages the NAVFAC Vertical Transportation Equipment (VTE) Program and provides policy, interpretation and direction for the application of NAVFAC VTE design criteria and safety codes and standards to elevators and other types of VTE in Navy facilities. For each NAVFAC Facilities Engineering Command (FEC), administration and application of VTE policy and direction shall be the responsibility of the FEC VTE Lead Certifying Official, by direction of the NAVFAC VTE Program Manager.

NAVFAC Elevator Design Criteria identifies consistent and uniform methods to be used to comply with the performance language of the applicable building and safety codes. In addition, NAVFAC Elevator Design Criteria specifies quality and performance requirements, for specific elevator components and systems, to ensure sustainability, effective performance, optimum life-cycle costs, and energy efficiency.

1-2 Scope.

The requirements of this Interim Technical Guidance (ITG) apply to both new construction projects and to the modernization of elevators in existing Navy facilities. This ITG must be utilized for the development of all design and contract documentation, including Request for Proposal (RFP), design submissions, and contractor submittal documents.

1-3 References.

References are provided in Appendix A. The listing is not exclusive; the elevator design and installation must comply with this ITG and all applicable reference documents and building and safety codes. The elevator and facility design must comply with the edition in effect at the time of contract award.

1-4 Content and Format.

This document is arranged by design disciplines. Within each chapter, the content is arranged by major elevator systems and components.

CHAPTER 2

PROJECT DEVELOPMENT

2-1 Criteria Documents.

The project development process shall determine the need for elevators through compliance with the most stringent requirements of the following criteria:

a. The new DoD "ABA (Architectural Barriers Act) Accessibility Standard" (DoD ABAAS) and the DEPSECDEF Memorandum

b. NAVFAC Facility Design Criteria for the facility type under design

c. NAVFAC Facility Design Program requirements for each specific project

2-2 Client Survey and Traffic Study.

To determine the elevator types, service, and quantity necessary for effective elevator service, the design process must include a client survey and a traffic study of the proposed facility design. The two basic elevator types are hydraulic elevators and electric traction elevators. The two categories of service that are recognized by ASME A17.1 are Passenger and Freight.

2-2.1 Client Survey and Traffic Study Factors

The client survey and traffic study are also conducted to determine requirements for elevator capacities, speeds, and elevator cab interior dimensions. For unique facilities and for facilities with critical demand requirements, the traffic study must be performed by a qualified elevator consultant. The following factors must be utilized in the analysis:

(1) Type and Use of Building

(2) Size and Height of Building

(3) Building Population

(4) Exterior Traffic Considerations

(5) Anticipated Traffic Flow

(6) National Elevator Industry, Inc. “Vertical Transportation Standards”

(7) LEED Certification Design Considerations

2-2.2 Passenger or Freight Classification

The designer and client must decide whether a passenger elevator or freight elevator is most appropriate for each elevator in the facility. This decision must be based on anticipated usage of each elevator.

2-2.2.1 If the elevator will be used for the movement of personnel, it must be designed as a passenger elevator. Any elevator that is a component of a handicapped accessibility route must be designed as a passenger elevator. Passenger elevators may be used for general freight loading and can be designed with a heavy-duty interior to resist damage from hand trucks and material.

2-2.2.2 If the elevator will be used strictly for the movement of materials, it may be classified and designed as a freight elevator. ASME A17.1 allows a freight elevator to have a greater platform area than a passenger elevator, given the same load rating.

Because of this, if an elevator is designed and installed as a freight elevator, that decision cannot be reversed at a later date and the elevator may never be utilized as a passenger elevator. The classification and design as a freight elevator severely limits the flexibility of use that is provided by the passenger elevator classification.

2-2.3 Handicapped Accessibility

If an elevator is a required component of a DoD ABAAS accessibility route, the elevator must be a passenger elevator and must be designed to comply with the requirements of DoD ABAAS.

2-2.4 Emergency Medical Services Accessibility

For all buildings, a minimum of one passenger elevator must be designed to accommodate emergency medical services access to all floors of the building. The elevator shall be of such a size and arrangement to accommodate a 24-inch by 84-inch (610mm by 1930mm) ambulance stretcher in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). If the facility is equipped with emergency power, this elevator must be powered by the emergency power system.

2-2.5 Elevator Operational Features

The client survey must include choices for elevator operational features, including:

- **a.** Emergency Commandeering Service
- **b.** Security and Access Control Systems

2-2.6 LEED Certification Design Options

a. High-Efficiency Permanent Magnet Gearless Machine

A high-efficiency gearless machine has been developed and incorporated into elevator design in the elevator industry. This elevator drive is similar to traditional gearless traction machines and can be located in the elevator machine room. However, the high-efficiency gearless machine utilizes an electric motor design that uses permanent magnets to increase the energy efficiency of the drive machine. This type of elevator drive system should be considered for all facilities. For Navy Facilities, the machine must be located in the elevator machine room.

b. "Regenerative Drive" Motor Control

"Regenerative Drive" motor control systems have been developed for electric traction elevators and are incorporated into elevator design within the elevator industry. This motor control system uses the energy that is developed when the elevator is running in an overhauling load condition. The drive converts the mechanical energy into electrical energy and feeds the electrical energy back to the facility power grid. This motor drive system is required, by this NAVFAC Elevator Design Guide, to be utilized for all gearless traction elevators. This motor drive system should be considered for all facilities with electric traction elevators.

2-3 Building Supporting Systems.

There are multiple building systems that interface with the elevator design and control system. The interface design is determined by the requirements of the International Building Code and numerous safety codes and standards. For new construction projects, building supporting systems must be designed to comply with applicable requirements. For modernization projects, the designer must verify and ensure that existing building systems are compliant with current safety code requirements and are compatible with proposed elevator systems.

2-3.1 Building Fire Alarm Panel

All elevators must be equipped with Firefighters' Emergency Operation (FEO). The FEO system provides an automatic elevator operational response to fire detection devices in the elevator machine room (MR), elevator lobbies, and in the elevator hoistway when required by safety code and/or NAVFAC Design Criteria. Design of the fire protection system is identified in UFC 3-600-01.

2-3.2 Emergency Power

For all buildings equipped with an emergency power generator, the emergency power system must provide the capability for the normal operation of at least one elevator on emergency power. In addition, the emergency power system must provide simultaneous or sequential movement of all elevators to the FEO Designated Level or Alternate Level. For new construction or modernization projects, the Designer of Record must determine if the client requires additional elevator operation under emergency power.

2-3.2.1 The design of elevator emergency power operation must address the following:

(1) How many and which elevators will run simultaneously.
(2) Location of elevator MRs and possible control wiring interconnections for sequential elevator return operation.
(3) Design of the electrical control circuit from the Automatic Transfer Switch (ATS) to the elevator controller.
(4) Ensure all elevator mainline disconnects are fed from the emergency power buss.

2-3.2.2 Electric Traction Elevators that are not designed for emergency power operation must be designed and equipped with an auxiliary power operating system that will, at a minimum, run the elevator to the next available landing, open and close the doors, and shut the elevator off at that landing.

2-3.2.3 Hydraulic Elevators that are not designed for emergency power operation must be designed and equipped with an auxiliary power operating system that will, at a minimum, run the elevator to the lowest landing, open and close the doors, and shut the elevator off at that landing. If the lowest landing is not the FEO Designated Landing, the elevator must stop at the appropriate Fire Response Floor, open the cab doors for a minimum of 30 seconds, prior to proceeding to the lowest landing. The auxiliary power supply must be of adequate supply to open and close the elevator cab doors as often as necessary to complete this operation.

2-3.3 Building Telephone and Communication Systems

Emergency communication is required from the elevator cab to an emergency response desk that is manned 24 hours a day. The emergency response communication system must be answered by emergency personnel and not by an automated answering system. In addition, the elevator cab communication system must automatically identify the elevator location and provide the capability for voice communication between the elevator MR and the elevator cab.

2-4 Contract Development and Support.

2-4.1 Unified Facilities Guide Specifications

For all contracts, utilize the complete and most current version of the Unified Facilities Guide Specifications (UFGS) for elevators to specify the project elevators. Any editing of non-bracketed paragraphs within the specification must be specifically approved by the responsible NAVFAC Elevator Program FEC LCO.

2-4.2 Design Coordination and Support

Coordinate project RFP elevator requirements with the NAVFAC FEC VTE LCO. In addition, VTE design submittals must be reviewed and approved by the NAVFAC FEC VTE LCO. Contact information for the NAVFAC VTE Program Managers and FEC VTE LCOs is provided in Appendix B.

2-4.3 NAVFAC VTE Program Design Comments or Questions

For elevator design questions and comments, contact the NAVFAC Elevator Program Manager, Deputy Program Manager, or the NAVFAC FEC Lead Certifying Official for your geographic area.

2-5 Application of Elevator Types to Facility Design.

This section identifies and describes the types of elevators that may be installed in Navy Facilities and provides requirements for the application of each type to the size and function of the facility. This section also identifies speed and travel requirements for each type and application.

2-5.1 Hydraulic Elevators

Hydraulic elevators may be used for facilities of 2 to 4 stories. Direct plunger hydraulic elevator design must be used for hydraulic elevators in Navy Facilities. Roped hydraulic elevators must not be used. Telescopic plungers and inverted cylinder/plunger assemblies must not be installed in Navy Facilities.

2-5.1.1 There are three main types of hydraulic elevators:

(a) In-ground Direct Plunger: An elevator cylinder and plunger assembly is installed in the ground, below the elevator cab. The elevator cab frame is connected to the top of the plunger and moves up as hydraulic fluid is pumped into the cylinder from the hydraulic elevator pump-unit reservoir. For a travel distance of 15 feet (258 cm) or

less, the rated speed shall be 125 fpm (38.1 m/min). For a travel distance between 15 feet (4.6 m) and 44 feet (13.4 m), the rated speed shall be 150 fpm (45.7 m/min). Do not exceed a maximum travel length of 44 feet (13.4 m) or a maximum of four floors for this type of elevator.

(b) Hole-less Direct Plunger: Either one or two hydraulic cylinder/plunger assemblies are installed vertically, in the elevator hoistway, with the bottom of the cylinder supported by the hoistway pit floor. The cab frame is attached to the top of the plunger and moves up as hydraulic fluid is pumped into the cylinder from a reservoir. The rated speed shall be 125 feet per minute (38.1 m/min) for this type of elevator. Travel is limited by pit depth and hoistway overhead.

(c) Roped: Roped Hydraulic elevators are not direct-plunder type elevators. Roped Hydraulic types shall not be used for Navy Facilities.

EXCEPTION: In the event of compelling design conditions, the use of a roped-hydraulic elevator may be appropriate for a new construction or modernization project. Approval for use of a roped-hydraulic elevator design may be requested, on an individual project, by submission of a written Request for Approval to the NAVFAC VTE Program FEC Lead Certifying Official (LCO). For an individual project design, the LCO is authorized to grant an exception to this restriction.

The roped design is similar to the standard hole-less elevator design. The difference is that a wire rope sheave is mounted to the top of the hydraulic plunger and steel hoist ropes are attached to the cylinder base, run over the sheave, and down to the cab frame. As the cylinder runs up, the 1:2 roping moves the elevator cab twice the distance of the plunger travel. Car speed is 150 feet per minute (45.7 m/min) and maximum travel length is 48 feet (14.6 m). The cost of acquisition, maintenance, and service for a roped-hydraulic elevator is substantially greater than for the direct plunger types.

2-5.2 Electric Traction Elevators

Electric Traction Elevators may be used for all facilities. There are two types of electric traction hoist machines, geared and gearless. In addition, there is a smaller, more efficient gearless elevator machine design that is relatively new to the elevator industry. The building height and travel of the elevator will determine the most effective application of each type of electric traction elevator.

2-5.2.1 The basic design is similar for each of the types of elevator drive machines. Steel hoist ropes (wire ropes) are suspended in the elevator hoistway and supported by the elevator drive machine. The elevator cab is fastened to one end of the hoist ropes and the elevator counterweight is fastened to the other end of the hoist ropes. The counterweight is used to counterbalance the weight of the elevator cab and load. Minimum car speed requirements are identified for each type of electric traction elevator machine.

(1) Geared Traction Machine: The elevator drive motor and geared machine are located in the elevator machine room. The motor drives a worm and ring gear assembly in the elevator drive machine. The ring gear turns the drive sheave which runs the elevator cab up and down in the hoistway. This type of electric traction elevator may be used for applications of 10 floors or less. Car speed must be a minimum of 350 feet per minute (106.7 m/min).

(2) Gearless Traction Machine: The elevator gearless drive machine is located in the elevator machine room. The motor connects directly to the drive sheave; there is no gear reduction unit. This type of electric traction elevator may be used for all applications and must be used for applications of greater than 10 floors. Car speed must be a minimum of 350 fpm (106.7 m/min) for 10 floors or less and 500 fpm (152.4 m/min) for greater than 10 floors.

(3) High Efficiency Gearless Machine: This type is very similar to the gearless traction machine above. However, the high efficiency gearless machine utilizes an electric motor design that incorporates permanent magnets to increase the energy efficiency of the drive machine. For Navy Facilities, the machine must be located in the elevator machine room.

For an elevator installation with a travel distance of less than 15 feet (4.6 m), the rated speed shall be a minimum of 125 fpm (38.1 m/min). For an elevator installation with a travel distance of 15 feet (4.6 m) to 40 feet (12.2 m), the rated speed shall be a minimum of 200 fpm (61 m/min). For an elevator installation of 10 floors or less, with a travel distance of 40 feet (12.2 m) - 100 feet (30.5 m), the rated speed shall be a minimum of 350 fpm (106.7 m/min). For an elevator installation with a travel distance of greater than 100 feet (30.5 m), the rated speed shall be a minimum of 500 fpm (152.4 m/min).

NOTE: For special purpose, special application, and higher capacity freight elevator installations, variations to this design criteria may be made, subject to the approval of the NAVFAC FEC VTE Lead Certifying Official, NAVFAC VTE Deputy Program Manager, or the NAVFAC VTE Program Manager.

CHAPTER 3

ARCHITECTURAL

Design and installation of elevator system must be in accordance with this ITG and all applicable reference documents and building and safety codes. A listing of reference documents is provided as Attachment A. The elevator design must comply with the edition in effect at the time of contract award.

3-1 Elevator Machine Room.

An elevator machine room must be provided for each individual elevator or for each elevator group. The elevator machine and elevator controller must be located in the elevator machine room.

3-1.1 Elevator Machine Room Location

The elevator machine room (MR) must be located directly adjacent to the elevator hoistway. For facilities that are not located in a flood zone, locate hydraulic elevator MR on the lowest landing served by the elevator.

3-1.1.1 For facilities located in a flood zone, locate MR on the next highest floor level that is above flood zone elevations, as determined by ASCE 24-05, Flood Resistant Design and Construction.

3-1.2 Elevator Machine Room Plans

Develop detailed plan and section drawings for elevator machine room. Provide all layout drawing information required by ASME A17.1. Include the following:

- **a.** Locate MR and hoistway on the same side of any building expansion joint.
- **b.** Provide fire resistant construction in accordance with UFC 3-600-01.
- **c.** MR enclosure may not contain access panels in the walls or ceiling.
- **d.** MR fire rated ceiling must not exceed 16 feet (4.9 m) in height.
- **e.** Design all machine beam support with hoistway wall beam-pocket construction.
- **f.** Size and configure the elevator MR so that there is a minimum clearance of 20 inches (508 mm) between any building component and a traction elevator drive machine.
- **g.** Size and configure the elevator MR so that there is a minimum clearance of 12 inches (305 mm) between any building component and an over-speed governor.
- **h.** Size and configure the elevator MR so that there is a minimum clearance of 10 inches (254 mm) between any building component and a hydraulic elevator pump unit.

3-1.2.1 Elevator MR design and construction must include the following:

- **a.** Provide out-swing MR door with lever handle on MR side of door and with key operated hardware from outside only.
- **b.** MR door must be self-closing and self-locking.
- **c.** On wall, inside of elevator MR, provide permanent sign that identifies the MR enclosure fire rating.

d. Louvers and undercuts of machine room door are not permitted.

3-1.2.2 Mechanical equipment and systems must conform to the following:

a. Provide an unobstructed 7 feet (2133 mm) minimum vertical clearance (headroom) below all solid items in the elevator machine room. The 7 foot (2133 mm) headroom requirement applies to all building components and all installed mechanical or electrical system components in the elevator MR.

b Only items that are directly related to the installation and operation of the elevator may be installed in the elevator machine room. In addition, pipes, ducts and conduit not related to the elevator system must not penetrate the machine room.

3-1.2.3 Elevator Machine Room Sound Transmission Limits. Provide elevator MR with a sound transmission coefficient design in accordance with the intermediate performance requirements of the National Elevator Industry, Inc. (NEII) Performance Standards Matrix. The measurement of audible operation of elevator MR equipment shall not exceed 65 decibels as measured at any location outside of the elevator MR.

3-1.3 Elevator Machine Room Access

A clear access route must be provided from the facility exterior entrance to the elevator MR door. The route must have a minimum width of 3 feet (914 mm) and a minimum height of 7 feet (2133 mm).

3-1.3.1 A stairway with a maximum inclination of 45 degrees must be provided for vertical access to an elevator MR. Vertical ladders, ships ladders, and alternating step tread designs must not be used for MR access. Steps must be designed with a maximum riser height of 8 inches (203 mm) and a minimum step tread depth of 8 inches (203 mm), as measured from each adjoining step, nose to nose. The height of the access stairs may not exceed a rise of 10 feet (3 m) without an intermediate landing.

3-1.4 Elevator Machine Room Floor Differences

For any difference in the height of the machine room floor exceeding 16 inches (406 mm), provide a standard railing on the upper floor level.

3-2 Elevator Hoistway.

3-2.1 Elevator Hoistway Pit Entrapment Protection

For all new design and construction projects, including additions to existing structures, the design of the elevator and hoistway must provide a minimum horizontal clearance of 20 inches (508 mm) between the side of the elevator platform/cab and any one wall of the elevator hoistway. The horizontal clearance of 20inches (508 mm) must be maintained from the pit floor to the top of the hoistway. Modernization of an elevator with an existing hoistway is not required to comply with this requirement.

3-2.2 Elevator Hoistway Plans

Develop detailed plan and section drawings for elevator hoistway. Show location of all support beams in the hoistway. For multiple elevators in the same hoistway, provide

divider beams for guide rail support brackets. Provide all layout drawing information required by ASME A17.1. Include the following:

a. Provide fire resistant hoistway construction in accordance with IBC.

b. Hoistway enclosure must not contain any access panels or doors in the walls or ceiling, except as necessary for the operation, maintenance, and service of the elevator.

c. Where a fire-rated entrance assembly is required, hoistway entrance assemblies must have a minimum fire rating of 1 ½ hour.

d. All hoistway door frames must be filled with grout to a height of 5 feet (1524 mm).

e. Hoistway enclosure must be plumb and have flush surfaces on the hoistway side.

f. Provide a lifting beam at the top of the hoistway for installation of elevator equipment.

g. For elevator machine rooms located directly above the elevator hoistway, the elevator machine room floor and elevator machine shall be directly supported by steel beam construction. Design all machine beam support with hoistway wall beam-pocket construction. Support must not depend solely on welds or bolts.

h. Hoistway ventilation must be provided in accordance with IBC Chapter 30.

3-2.2.1 Only mechanical equipment and systems that are directly related to the installation and operation of the elevator may be installed in the elevator hoistway. In addition, pipes, ducts, and conduit not related to the elevator system must not penetrate the hoistway.

3-3 Elevator Hoistway Pit.

3-3.1 Elevator Hoistway Pit Ladder

A hoistway pit ladder must be provided for all pits with a depth of that exceeds 35 inches (889 mm). Detail pit ladder on the detail drawings of the elevator pit. In addition to safety code requirements, include the following:

a. Provide continuous, non-slip, horizontal rungs every 12 inches (305 mm) for the full height of the pit ladder.

3-3.2 Elevator Hoistway Pit Fall Protection

For pit depths of 6 feet (1829 mm) or greater, a fall protection system must be designed and installed adjacent to the hoistway pit ladder for personnel access to and egress from elevator hoistway pit.

3-3.3 Elevator Hoistway Pit Sump and Sump Pump

All elevator hoistways must be equipped with a sump pit, sump pump, and permanent discharge piping to a point outside of the elevator hoistway and MR. Comply with the following:

a. Minimum sump pump discharge must be 50 gallons per minute (189 lit/min), per elevator. Sump pump and piping must be sized to accomplish this output, regardless of head pressure or piping run.

b. Design hoistway sump pit large enough to fully enclose submersible sump pump and control sensors below hoistway pit floor level.
c. Discharge to an approved location that can accommodate a full, continuous pump output and does comply with all applicable discharge permits, regulations, and statutes.
d. Installation of the pit sump pump must not present a tripping hazard for personnel entering and exiting the elevator hoistway pit.
e. Installation of the pit sump pump must not encroach on the safety code required pit refuge space.
f. Provide fully supported, removable grate cover with top of grate flush with pit floor.
g. Coordinate power requirements with Electrical engineer.

3-3.3.1 In addition to the requirements of 3-3.2, hydraulic elevator installations must be designed with a sump pump oil sensing control system to allow water to be pumped out of the sump without pumping oil/hydraulic fluid from the elevator hoistway pit. The sump pump control system must include an audible alarm and visual indicators for water and oil. The alarm indicators and controls must be installed in the elevator machine room.

NOTE: For the modernization of existing facilities that are not equipped with a sump pit, the sump pit is not required to be installed. All other requirements of 3-3.3 must be met.

CHAPTER 4

STRUCTURAL

Structural design must be in accordance with this ITG and all applicable reference documents and building and safety codes. A listing of reference documents is provided as Attachment A. The elevator design must comply with the edition in effect at the time of contract award.

4-1 Elevator Machine Room.

4-1.1 Building construction must be designed to provide adequate support for the total static and impact loads on all machinery and sheave beams, supports, floors, and foundations. In all seismicity regions, ensure adequate structural support for all elevator equipment as required by the elevator manufacturer's design, applicable safety codes, and UFC 3-310-04.

4-1.2 Locate the elevator hoistway and elevator machine room on the same side of all building expansion joints.

4-2 Elevator Hoistway.

4-2.1 Building construction must be designed to provide adequate support for elevator guide rails and rail brackets. In all seismicity regions, ensure adequate structural support for the attachment of the elements of the elevator support system as required by the elevator manufacturer's design, applicable safety codes, and UFC 3-310-04.

4-2.2 Elevator design submittal must include a design analysis for attachment of elevator guide rails and rail brackets to the building structure. The design analysis must include calculations for structural loading and all potential reaction loads.

4-2.2 Clay tile or brick shall not be used in the construction of hoistway walls. Hollow concrete block (CMU), if used, must be filled solid with concrete or grout.

4-3 Elevator Hoistway Pit.

4-3.1 Hoistway drawings must indicate water stops in the walls and waterproofing for elevator pit floor and walls, if these items are not shown on architectural drawings.

4-3.2 Hoistway pit structure must be designed for all static and reaction loads that it will be subjected to by the elevator system. Indicate details for sump pump pit and the impact of the sump pit on the foundation for the structure.

CHAPTER 5

MECHANICAL

Design and installation of mechanical systems must be in accordance with this ITG and all applicable reference documents and building and safety codes. A listing of reference documents is provided as Attachment A. The elevator design must comply with the edition in effect at the time of contract award.

5-1 Elevator Machine Room.

5-1.1 Elevator MR Temperature and Humidity Control

An independent dedicated HVAC heating and cooling system must be designed and provided for every elevator MR, to maintain MR temperature between 50 and 90 degrees F (10 to 32 degrees C) and relative humidity between 35% and 60% at all times and in all weather conditions. HVAC system design must include the BTU heat load generated by operation of the elevator equipment. Coordinate with Electrical Design requirements.

5-1.1.1 Elevator controller cabinet AC units must not be used for conditioning.

5-1.1.2 HVAC conditioning equipment must not be located above elevator equipment. AC condensate lines must drain to a location outside of the elevator MR and hoistway.

5-1.2 Mechanical Equipment Installation

Mechanical equipment and systems must conform to the following:

- **a.** Provide an unobstructed 7 feet (2133 mm) minimum vertical clearance (headroom) below all solid items in the elevator machine room. The 7 foot (2133 mm) headroom applies to all building components and all installed mechanical or electrical system components.
- **b** Only items that are directly related to the installation and operation of the elevator may be installed in the elevator machine room. In addition, pipes, ducts and conduit not related to the elevator system must not penetrate the machine room.
- **c.** There must be a minimum of 20 inches (508 mm) clearance between an elevator drive machine and any mechanical or electrical equipment that is installed in the elevator machine room.

5-1.3 Machine Room Sound Level

The acoustic output of any equipment in elevator machine room must not exceed 80 dBA, measured at any point in the elevator machine room.

5-2 Elevator Hoistway.

5-2.1 Elevator Hoistway Ventilation

Provide exterior ventilation of hoistway in accordance with the requirements of IBC. If ventilation is required, provide a weatherproof louver with a minimum free area of 3 1/2% of the area of the hoistway pit but in no case can it be less than a free area of 3 square feet

(2787 square cm). The hoistway wall penetration must comply with the ASME A17.1 elevator safety code recess and setback requirements.

5-2.1.1 To prevent hoistway corrosion and the loss of facility heating and cooling, an automatic louver must be provided for closing the hoistway ventilation opening, subject to the requirements of IBC. The IBC and NFPA 72 safety code allow the louver to be held in the closed position as long as it is monitored and controlled by the facility fire alarm panel. All hoistway ventilation openings must fully open as follows:

- **a.** upon loss of building power
- **b.** upon actuation of any building fire alarm initiating device
- **c.** upon actuation of a manual override control located at the building fire alarm control panel

Hoistway ventilation must not close automatically. Manual override control must be utilized for closing the hoistway ventilation louver.

5-2.2 Mechanical Equipment Installation

Only mechanical equipment and systems that are directly related to the installation and operation of the elevator may be installed in the elevator hoistway. In addition, pipes, ducts and conduit not related to the elevator system must not penetrate the hoistway.

5-3 Elevator Hoistway Pit.

5-3.1 Elevator Hoistway Pit Sump and Sump Pump

For all elevators, a sump pit and an automatic sump pump system must be provided. Permanent discharge piping must be provided to a point outside of the elevator hoistway and MR. Comply with the following:

- **a.** Minimum sump pump discharge must be 50 gallons per minute (189 lit/min), per elevator. Sump pump and piping must be sized to accomplish this output, regardless of head pressure or piping run.
- **b.** Provide fully supported, removable grate cover with top of grate flush with pit floor.
- **c.** Discharge to an approved location that will accommodate full pump output and comply with all applicable discharge permits, regulations, and statutes.
- **d.** Coordinate sump pump size with Architect to ensure that the sump pump and control sensors will fit completely within the sump.
- **e.** Coordinate power requirements with electrical engineer.

5-3.1.1 In addition to the requirements of 5-3.1, hydraulic elevator installations must be designed with a sump pump oil sensing control system to allow water to be pumped out of the sump without pumping oil/hydraulic fluid from the elevator hoistway pit. The sump pump control system must include an audible alarm and visual indicators for water and oil. The alarm indicators and controls must be installed in the elevator machine room.

5-3.2 Elevator Hoistway Pit Sprinkler Protection

In buildings protected with an automatic sprinkler system, provide sprinkler in the pit for hydraulic elevators (except in Italy). Locate sprinkler head no more than 2 feet (609 mm) above the pit floor.

CHAPTER 6

ELECTRICAL

Design and installation of all electrical wiring and equipment must be in accordance with this ITG and all applicable reference documents and building and safety codes. A listing of reference documents is provided as Attachment A. The elevator design must comply with the edition in effect at the time of contract award.

6-1 Elevator Machine Room.

6-1.1 Elevator Power Supply

For each elevator group, a separate electrical power service must be provided from the main building electrical distribution panel to the elevator machine room. The electrical service must comply with the following:

a. The elevator electrical service must include a fourth-wire dedicate earth ground.

b. The electrical power supply must provide a balanced 3-phase power supply with a maximum voltage variation of 5% between any two phases.

c. Designer must consider type of elevator drive specified, i.e., SCR, VVVF, etc., and design service accordingly.

6-1.2 Elevator Disconnecting Means

Locate the elevator disconnecting means on the wall inside the MR, on the strike jam side of the MR door, within sight of the elevator equipment it controls. The disconnecting means must be numbered to correspond to the identifying number of the driving machine that it controls.

6-1.2.1 Ensure that each elevator disconnecting means has the following signs permanently attached:

a. Permanent sign to identify the location of the supply side overcurrent protective device.

b.
WARNING
PARTS OF THE CONTROLLER ARE NOT
DE-ENERGIZED BY THIS SWITCH

6-1.2.2 For all elevators with fire protection sprinklers in the elevator MR or top of hoistway, provide a shunt trip circuit breaker in the elevator MR for each individual elevator main power, and emergency power if provided. Shunt trip breaker design must comply with the following:

a. Shunt trip breaker must be designed to be operated by actuation of the sprinkler flow switch(s) designed to automatically open the power supply to the elevator. Power must be restored manually.

b. Breaker enclosure must include a safety-switch type handle for manual operation of the breaker.

c. Breaker handle must be capable of being locked in the open position only.

6-1.2.3 A sprinkler line flow switch must be provided, according to the design requirements of Chapter 7, Fire Protection. The flow switch must be equipped with an electrical circuit that will actuate the elevator main-line shunt trip disconnect. The sprinkler line flow switch control circuit must be monitored for the presence of operation voltage. Loss of voltage shall cause actuation of a supervisory signal and alarm at the building fire protection panel.

6-1.2.4 Hydraulic elevators that are not designed for building emergency power generator operation must be designed and equipped with auxiliary power lowering operation for the purpose of lowering the car in the case of failure of the main power supply. When an elevator is equipped with auxiliary power lowering operation, the main line disconnect must be designed with an auxiliary contact to prevent automatic lowering operation when the main line disconnect is in the open position.

6-1.3 MR 120 VAC Lighting and Receptacle Circuit

A separate 120 VAC branch circuit must be provided for the elevator MR lighting and receptacles. The MR lighting shall not be equipped with automatic controls or be fed from the load side of a GFCI circuit.

6-1.3.1 A minimum of two 2-light, 4 feet (1.2 m) long fluorescent lighting fixtures must be provided for lighting of the elevator MR. The fixture must have a one piece, molded, high-impact clear acrylic diffuser with a secure seal against dust and moisture. MR lighting must provide a minimum of 19 fc at floor level, in all areas of the MR.

6-1.4 Separate Branch Circuits

For each of the following circuits, provide a separate, dedicated branch circuit with a fused disconnect or breaker in the elevator MR. Individual disconnects and breakers must be designed to be lockable in the open position only.

- **a.** Elevator 120 VAC circuit for elevator cab lighting and receptacles.
- **b.** Elevator cab HVAC equipment circuit, if provided.
- **c.** Elevator hoistway pit sump pump power and control system.

6-1.4.1 For all MR disconnects, provide a permanent sign, on each disconnect, to identify the location of the supply side overcurrent protective device.

6-1.5 Emergency Power

When elevators are designed to operate on emergency power, there are additional considerations that must be addressed in the design of the electrical power and control wiring. When the building design includes emergency power for multiple elevator machine rooms, coordination with the NAVFAC FEC VTE LCO is recommended. At a minimum, the electrical service design must comply with the requirements of Section 6-1 and the following:

- **a.** The MR disconnecting means must disconnect both normal and emergency power.
- **b.** Emergency power system must be designed to operate selected elevator(s) at rated speed with rated load.

c. System design must accommodate automatic sequential operation to bring all elevators to the designated floor and provide selected elevator(s) with emergency power operation. Control wiring may be required between MRs for sequential operation.

d. Provide manual selector switch in main elevator lobby area(s) to allow emergency personnel to override the automatic emergency power selection.

e. Provide emergency power for MR lighting and MR HVAC equipment.

f. Provide emergency power for Cab lighting and Cab HVAC equipment.

g. Provide emergency power for hoistway pit sump pump operation.

6-1.6 Emergency Communication Systems

Provide telephone outlet with dedicated line next to each elevator controller for emergency phone service in elevator car. Indicate outlets on telephone riser.

6-1.6.1 Provide emergency communication between the elevator cab and the elevator MR for all elevators with a travel of 60 feet (18.3 m) or greater and for all elevators with a remote MR. A remote MR is defined as a MR that does not share a contiguous wall, floor, or ceiling with the elevator hoistway.

6-1.7 Firefighters' Emergency Operation (FEO)

The design of the building fire detection and alarm system must include an effective interface with the elevator controller for actuation of Fire Fighter's Emergency Operation (FEO), in accordance with ASME A17.1.

6-1.7.1 For FEO actuation, provide ceiling mounted fire alarm initiating devices in elevator lobbies, elevator MR, and sometimes in the elevator hoistway, in conformance with UFC 3-600-01. Indicate devices on electrical drawings unless there are separate fire protection drawings. Coordinate with Fire Protection Engineer.

6-1.7.2 For a code compliant interface with the elevator controller, the fire alarm initiating device system will require 3 to 4 relay modules for actuation of the elevator FEO. Mount FEO operation modules on the wall inside the elevator MR.

6-1.8 Elevator Hoistway Pit Sump and Sump Pump

For hydraulic elevator installations, the hoistway pit sump pump control system audible and visual alarm indicators and controls must be installed in the elevator machine room.

6-1.9 General Wiring requirements

6-1.9.1 Only electric wiring, raceways, and cables used directly in connection with the elevator are permitted inside the elevator machine room. Allowable wiring includes wiring for signals, lighting, heating, air conditioning, and venting of the elevator MR.

6-1.9.2 All conductors and optical fibers in the elevator MR must be in conduit.

6-2 Elevator Hoistway.

6-2.1 120 VAC Hoistway Lighting and Receptacles

A minimum of two 2-light, 4 feet (1.2 m) long fluorescent lighting fixtures must be provided for lighting of the elevator hoistway pit. The fixtures must have a one piece, molded, high-impact clear acrylic diffuser with a secure seal against dust and moisture. A similar fixture must be provided at a minimum of every 10 feet (3 m) vertically up the hoistway. The fixture at the top of the hoistway must be mounted on the ceiling.

6-2.1.1 For control of the hoistway lighting circuit, provide two 3-way switches inside the elevator hoistway, at a height of 4 feet (1.2 m) above the top and bottom elevator landings. Mount the switches on the hoistway wall, adjacent to the hoistway entrance strike jamb. The lower level lighting switch must be located adjacent to the hoistway pit access ladder.

6-2.1.2 Pit lighting must provide a minimum of 10 fc at the pit floor in all areas of the pit.

6-2.2 General Wiring Requirements

6-2.2.1 Only electric wiring, raceways, and cables used directly in connection with the elevator are permitted inside the hoistway. Allowable wiring includes wiring for signals, lighting, heating, air conditioning, and venting of the elevator cab; also for fire protection, for pit pump, and for heating, lighting, and venting of the hoistway.

6-2.2.2 All conductors and optical fibers in the hoistway, except traveling cable, must be in conduit.

6-2.2.3 Traveling cables must be suspended by a self-tightening webbed hanger or internal suspension member.

6-3 Elevator Hoistway Pit.

6-3.1 Sump Pump Receptacle

Provide a dedicated simplex receptacle, without GFI protection, to supply the permanently installed sump pump. Mount sump pump receptacle 5 feet (1524 mm) above elevator pit floor. Provide LED light to verify circuit is energized.

6-3.2 Hoistway Pit GFCI Receptacles

Provide a separate branch circuit supplying the hoistway pit lighting and a minimum of two duplex GFCI receptacles in the pit. Locate one receptacle on each side wall of the hoistway, at 3 feet (915 mm) above pit floor. For hydraulic elevators, provide one additional receptacle on the rear wall of the hoistway at a height of 3 feet (915 mm) above the pit floor for scavenger pump power.

6-3.3 NEMA 4 Electrical Equipment

All electrical equipment located less than 4 feet (1219 mm) above the pit floor shall be weatherproof (NEMA4) and wiring shall be identified for use in wet locations in accordance with the requirements in NFPA 70.

CHAPTER 7

FIRE PROTECTION

Design and installation of the fire alarm and fire protection systems and components related to elevator function and control must be in accordance with UFC 3-600-01, this ITG, and all applicable reference documents and building and safety codes. A listing of reference documents is provided as Attachment A. The elevator design must comply with the edition in effect at the time of contract award.

7-1 Fire Alarm System.

7-1.1 Fire Alarm Initiating Devices

Fire alarm initiating devices must be provided for actuation of elevator Firefighters' Emergency Operation (FEO):

7-1.1.1 Elevator Controller Interface with Fire Alarm System.
The design of the fire detection and alarm system must include an effective interface with the elevator controller. Indicate detectors and connections on fire protection drawings or on electrical drawings if fire protection drawings are not provided. Coordinate with Electrical Engineer.

7-1.1.2 For current code compliance, the smoke detector/fire alarm initiating device system typically requires 3 to 4 relay modules for Firefighters' Emergency Operation. Mount all FEO operation modules on the wall inside the elevator MR.

7-2 Fire Protection System.

In buildings protected with an automatic sprinkler system, comply with UFC 3-600-01, applicable codes, and the following.

7-2.1 Elevator Machine Room and Elevator Hoistway

The following applies to sprinklers in the elevator MR and hoistway sprinklers located more than 2 feet (610 mm) above the pit floor.

7-2.1.1 A supervised shut-off valve, check valve, flow switch, and test valve must be provided in a dedicated sprinkler line feeding the elevator machine room and/or hoistway. These items must be located outside of and adjacent to the machine room and/or hoistway. Actuation of the flow switch shall remove power to the elevator by shunt trip breaker operation. Shunt trip actuation shall be instantaneous; the flow switch must not have time delay capability.

7-2.2 Elevator Hoistway Pit

Actuation of a pit sprinkler within 24 inches (610mm) of the pit floor shall not remove power to the elevator by shunt trip breaker operation.

7-2.3 Fire Extinguisher

A fire extinguisher must be provided and installed on the wall, inside the elevator machine room, on the strike-jam side of the machine room door. Indicate location on MR drawings.

CHAPTER 8

ELEVATOR SYSTEMS AND COMPONENTS

Design and installation of all elevator systems and components must be in accordance with this ITG and all applicable reference documents and building and safety codes. A listing of reference documents is provided as Attachment A. The elevator design shall comply with the edition in effect at the time of contract award.

8-1 Elevator Machine Room.

8-1.1 Elevator Hoist Machine

The elevator hoist machine, including hoist motor and assembly, must be located within the elevator machine room (MR).

8-1.1.1 Non-Proprietary Elevator Hoist Machine
The elevator hoist-machine must be a non-proprietary product and must comply with the following paragraphs.

8-1.1.1.1 The elevator hoist machine configuration and installation design must be mechanically and electrically interchangeable with a minimum of 3 other elevator manufacturer's hoist machines that are readily available in the elevator industry.

8-1.1.1.2 The elevator hoist machine manufacturer must provide comprehensive factory training to include installation, adjustment, service, and maintenance. The training must be identified as available to any licensed elevator contractor. The manufacturer must have an established and documented schedule, with pricing, for factory training classes that have been provided for a minimum period of one year prior to contract award date of the applicable project.

8-1.1.1.3 The elevator hoist machine must be identified as available for purchase and installation by any licensed elevator contractor. In addition, all parts, diagnostic tools, and software must be available for purchase, installation, and use by any licensed elevator contractor; "exchange-only" provisions for the purchase of spare parts are not acceptable.

8.1.1.2 In Navy Facilities, only stranded steel wire rope may be used for elevator suspension and counterbalance. Aramid fiber ropes, coated steel ropes, and non-circular coated steel belts shall not be used for elevator suspension and counterbalance.

8.1.1.2.1 The minimum diameter of hoisting and counterweight ropes shall be 3/8 inches (9.52 mm).

8.1.1.3 Elevator hoist machine shall be equipped with machine manufacturer designed and installed standard means for the manual release of the driving-machine brake.

8-1.1.4 The elevator hoist motor must be designed and installed so that motor amperage does not exceed nameplate motor amperage when the elevator is running in any direction or loading condition.

8-1.2 Elevator Controller

The elevator controller must be located in the elevator MR. All elevator motor control equipment and wiring must be located in the elevator machine room.

8-1.2.1 Non-Proprietary Controller

The elevator controller must be a non-proprietary microprocessor controller. The controller equipment, software, and manufacturer must comply with the following paragraphs.

8-1.2.1.1 The controller must be manufactured and sold by an elevator controller manufacturer that does not engage in installation, service, or maintenance of elevators.

8-1.2.1.2 The elevator controller manufacturer must provide comprehensive factory training to include controller installation, adjustment, service, and maintenance. The training must be identified as available to any licensed elevator contractor. The manufacturer must have an established and documented schedule, with pricing, for factory training classes that have been provided for a period of at least two years prior to contract award date of the applicable project.

8-1.2.1.3 The elevator controller must be identified as available for purchase and installation by any licensed elevator contractor. In addition, all parts, diagnostic tools, and software must be available for purchase and installation and use by any licensed elevator contractor; “exchange-only” provisions for the purchase of spare parts are not acceptable.

8-1.2.1.4 The elevator controller manufacturer must publish an industry competitive price listing for all controller parts, diagnostic tools, and software.

8-1.2.1.5 The elevator controller manufacturer must provide a technical support phone service with live technical support available during standard working hours. The service must be accessible to any licensed elevator contractor at an industry competitive price. The hot-line must provide technical support for installation, adjustment, maintenance, and troubleshooting of the elevator controller and elevator components.

8-1.2.2 Elevator Controller Interface Cabinet

A separate elevator control cabinet must be provided with an integrated human interface system. The separate controller interface cabinet must be supplied by the elevator controller manufacturer and include a minimum 12 inch (305 mm) wide keyboard and a minimum 10 inch (254 mm) monitor. The system must provide complete elevator controller interface capability and must include the elevator controller manufacturer’s

comprehensive package of installation and diagnostic software. The microprocessor interface system must provide unrestricted access to all parameters, all levels of adjustment, and all flags necessary for installation, adjustment, maintenance, and troubleshooting of the elevator. Elevator controller fault log must provide capability for storage of all faults for a minimum of 60 days and the ability to download or print the fault log. Expiring software, degrading operation, and "key" access controls are not acceptable.

8-1.2.2.1 The elevator controller interface cabinet must comply with arc-flash protection requirements of NFPA 70E and UFC 3-560-01.

8-1.2.3 The controller must be designed to automatically reestablish normal elevator operation upon any temporary loss of power, regardless of duration.

8-1.2.4 New elevator controllers in Navy facilities must carry a current certificate of safety code compliance issued by the Technical Standards and Safety Authority (TSSA), Toronto, Canada.

8-1.2.5 Hydraulic elevators that are not designed for building emergency power generator operation must be designed and equipped with auxiliary power lowering operation for the purpose of lowering the car in the case of failure of the main power supply. This operation must lower the elevator to the lowest landing, open the doors, and shut the elevator off at that landing.

8-1.2.5.1 If the lowest landing is not the Firefighter's Emergency Operation (FEO) Designated Landing, the elevator must stop at the FEO Designated Landing and open the cab doors for a minimum of 30 seconds, prior to proceeding to the lowest landing. The auxiliary power supply must be of adequate supply to open the elevator cab doors as required.

8-1.3 Elevator Motor Drive

8-1.3.1 For all elevators, electrical output from the elevator drive and controller must limit Total Harmonic Distortion to a maximum of 5%. No single harmonic may exceed 3%.

8-1.3.2 All gearless traction elevators must be equipped with regenerative motor drive units. Whenever the elevator is traveling in an overhauling load condition, the regenerative drive will feed generated electricity back to the building power grid.

8-1.3.3 Electrical supply wiring between the elevator controller and the elevator drive motor must be run in a dedicated conduit that is separate from elevator control wiring (i.e. encoder and tachometer wiring).

8-1.4 Emergency Brake

When an emergency brake is required by ASME A17.1, the emergency brake shall be designed to decelerate the car be acting directly on the elevator hoist ropes.

8-1.5 Overspeed Governor Rope

Only stranded steel wire rope may be used for overspeed governor applications.

8-1.6 Machine Room Sound Level

Provide elevator MR equipment with a sound transmission coefficient design in accordance with the intermediate performance requirements of the NEII Performance Standards Matrix. The measurement of audible operation of any equipment in the elevator MR shall not exceed 80 decibels, as measured at any location inside of the elevator MR. Acoustic measurement shall be taken with the elevator MR door in the fully closed position.

8-1.7 Machine Room Cabinet

For storage of O&M Documentation and Wiring Diagrams, a locking metal cabinet must be provided and secured to the wall of the MR. Cabinet must have a minimum size of 20 inches (508mm) W X 12inches (305 mm) D X 30 inches (762 mm) H and must be sized large enough to accommodate all O&M Data and documentation.

8-1.8 Corrosion Protection

All phosphorus metal elevator equipment and building components in the elevator machine room must be painted with a minimum of one coat of enamel paint.

8-2 Elevator Hoistway.

8-2.1 Elevator Hoistway Entrance Assemblies

8-2.1.1 For a two hour fire rated hoistway, a minimum 1 ½ hour fire rated hoistway entrance assembly must be installed at every landing.

8-2.1.2 For every landing, a one-piece nickel-silver, stainless-steel, or nickel-bronze entrance sill must be installed. The top of the landing sill must be flush, within 1/16 inch (4.2 mm), with the top of the finish floor. The same material and design must be used for all hoistway landing and elevator cab entrance sills.

EXCEPTION: Freight elevators with vertical bi-parting doors must be equipped with a minimum 12 inch (305 mm) deep, diamond-plate, steel sill at each landing. Hoistway doors must be equipped with steel truckable-sill angles.

8-2.1.3 For every landing, the hoistway entrance assembly door frame must be solidly grouted to a height of 5 feet (1524 mm) above the landing sill.

8-2.1.4 For every landing, a hoistway door unlocking device must be installed to allow elevator and trained emergency personnel to open the hoistway door from the landing.

8.2.1.4.1 For all jurisdictions that do not permit a hoistway door unlocking device, a keyed escutcheon hole insert must be installed at every landing. Access to the insert key must be limited to elevator personnel.

8-2.2 Elevator Guide Rails

T-section type guide rails must be used for all car and counterweight guide rails. Rail shanks must be painted with one coat of black enamel.

8-2.3 Elevator Hoistway Pit

8-2.3.1 The hoistway pit stop switch must be a "push-to-stop" type elevator stop switch.

8-2.3.2 Structural steel pit channels must be installed to serve as mounting surfaces for main guide rails, counterweight guide rails, car buffers, and counterweight buffers.

8-2.4 Elevator Hoistway Pit Entrapment Protection Area

A secondary push-to-stop pit stop switch must be provided within the hoistway pit entrapment protection egress area, at a height between 50 inches (1270 mm) and 60 inches (1524 mm) above the pit floor.

8-2.5 Corrosion Protection

All phosphorus metal elevator equipment and building components in the elevator hoistway must be painted with a minimum of one coat of black enamel paint, except where a coating of paint may affect the operation of the elevator and equipment.

8-3 Elevator Cab and Landing Fixtures.

8-3.1 General Requirements

Unless otherwise specified by the Designer of Record, all elevators in a facility must be designed with cab and landing fixtures and panels of identical and uniform design, material, finish, and components. All fixtures and devices must be engraved to identify function and operating positions and backfilled with a contrasting color.

8-3.1.1 Elevator Cab Lighting Automatic Shutoff

Elevator Cab Lighting must be equipped with an automatic shutoff control system that will turn the elevator cab lights off when there is no demand for elevator operation. The automatic cab lighting control shall be programmed to turn cab lights off when there have been no car calls or hall calls for a designated period of time. The time delay must be adjustable from 5 minutes to 30 minutes.

8-3.1.2 Vandal Resistant Fixtures and Buttons

All cab and landing fixtures must be industry standard, vandal resistant design with metal buttons and positive stop assembly design.

8-3.1.3 LED Illumination
All illuminating fixture components must utilize LED lighting for energy efficiency.

8-3.1.4 Fixture Switches and Keys
Elevator manufacturer's standard grade may be used for all key switches unless otherwise specified. For all keyed car and landing fixtures, a minimum of twelve keys must be provided for each unique cylinder.

8-3.2 Firefighters' Emergency Operation (FEO)

8-3.2.1 The FEO designated landing must be determined during the facility design process and identified in the design submittal package. The determination of the FEO landing must be coordinated with the base or local fire department that will respond to a fire alarm at the facility.

8-3.2.1.1 A separate FEO Phase I fixture must be provided at the designated fire response floor. The FEO Phase I fixture must be mounted on the opposite side of the elevator entrance from the landing hall call fixture.
8-3.2.1.2 Both the FEO Phase I and Phase II visual indicators must be identical and must be designed to operate with flashing operation to indicate when a fire alarm initiating device has actuated in the elevator MR and/or hoistway.

8-3.2.1.3 FEO Phase I and Phase II Operating Instructions must be engraved and backfilled with a contrasting color.

8-3.3 Elevator Cab Emergency Communication System

All elevators are required to be equipped with emergency communication. Multiple elevators with a common machine room must be provided with a single telephone line that supplies a group communication device. The group communication device must provide 2-way communication capability to each elevator in the group.

8-3.3.1 The Elevator Communication Failure visual and audible signals must be located in the FEO Phase I fixture. When activated, the visual indicator shall illuminate continually. The audible indicator must be a minimum of 65 dBA.

8-3.3.2 For elevators with a travel of 60 feet (18 m) or more, ASME A17.1 requires a means of 2-way voice communication, within the building and accessible to emergency personnel. The means must be located at the building primary fire alarm panel.

8-3.3 Car Operating Panel (COP)

In addition to items required by safety code, the elevator COP must include the following:

Passenger accessible devices:

- illuminating “Alarm” button
- key-operated “Independent Service” switch

- momentary push-button communication device for emergency voice communication with both the elevator MR and an emergency desk that is manned continually, 7 days a week and 24 hours a day.

Behind a locked service panel:

- toggle type cab lighting on/off switch
- toggle type two-speed cab fan switch
- key operated “Hoistway Enable” switch for Hoistway Access Operation
- key operated “In-Car Inspection Operation” switch
- service panel door shall be designed with elevator certificate window that will accommodate a 4 inch (101 mm) X 6 inch (152 mm) operating certificate
- 110 VAC GFCI Duplex Receptacle

8-3.4 Elevator Landing Fixtures

8-3.4.1 A hall call riser must be provided adjacent to each elevator.

8-3.4.2 All elevator hall call fixtures must be engraved with the ASME A17.1 “Elevator Corridor Call Station” pictograph. Pictograph must be engraved and backfilled with a contrasting color.

8-3.5 Hoistway Access Switches

All elevators must be equipped with hoistway access operation, with switches at the top and bottom terminal landings. Locate switch in the lobby wall, 6 feet (1800 mm) above floor level and within 12 inches (300 mm) of elevator hoistway entrance frame.

8-3.6 Emergency Lock Box

For every elevator, a keyed lockbox must be provided at the FEO Designated Landing. The lockbox must be flush mounted in the wall, adjacent to and within 20 inches (508 mm) of the hoistway entrance assembly. Locate lockbox at a height of 60 inches (1524 mm) above the landing sill. The lockbox must have a minimum size of 6 inches (152 mm) W X 8 inches (203 mm) H X 1.25 inches (32 mm) D. The locking mechanism must utilize the ASME A17.1 FEO key.

8-4 Elevator Car and Counterweight Components.

8-4.1 Roller Guides

Coil-spring loaded roller guide assemblies must be installed in adjustable mountings on each side of the elevator car and counterweight frames, in accurate alignment at top and bottom of frames. Mounting assemblies must include integral seismic retainer plates.

8-4.2 Car Door Operator

The elevator car door operator equipment and circuitry must be designed and installed as discreet communication. Serial communication must not be used for this system.

8-4.3 Infra-red Car Door Protection

An Infra-red Curtain Unit (ICU), with a minimum of 150 beams, must be used to protect the full height and width of the car door opening.

8-5 Hydraulic Elevator Components and Systems.

For all projects, direct plunger hydraulic elevators must be utilized in Navy Facilities. Roped-hydraulic elevators must not be installed in Navy facilities without written authorization and exception from the cognizant NAVFAC FEC VTE Program LCO.

8-5.1 Hydraulic Cylinder/Plunger Assemblies

The Hydraulic Cylinder/Plunger Assembly design must comply with the following:

a. Telescopic plungers must not be installed in Navy Facilities.

b. Inverted cylinder/plunger assemblies must not be installed in Navy Facilities.

8-5.2 Hydraulic Elevator Machine/Pump Unit

8-5.2.1 Hydraulic Control Valve.

Every hydraulic elevator must be equipped with a down-speed regulated control valve. In both directions of travel and in all loading conditions, the control valve must operate the elevator at a minimum of rated speed and at a maximum of 110% of rated speed.

8-5.2.1.1 The hydraulic control valve must have built-in adjustment capability to operate the elevator at 140% of rated speed, to facilitate periodic testing of the over-speed safety valve.

8-5.2.2 Hydraulic Working Pressure.

The hydraulic system must be designed and installed so that the working pressure of the elevator, running in the up direction, at rated speed, with rated load, does not exceed 500 psi (3447 kPag).

8-5.2.3 Hydraulic Pump Motor.

The hydraulic pump and motor must be designed and installed so that motor amperage does not exceed nameplate motor amperage when the elevator is running in the up direction, at rated speed, with rated load.

8-5.2.3.1 The hydraulic pump motor must be rated for 120 starts per hour and a minimum Class F insulation.

8-5.2.4 Motor Control.

The hydraulic elevator motor control must utilize an electronic, soft-start motor starter.

8-5.2.5 The elevator system must be designed for and must operate to maintain the hydraulic fluid temperature within the optimum operating range specified by the hydraulic control valve manufacturer.

8-5.2.6 The hydraulic fluid reservoir capacity must be designed for and supplied with a minimum of full plunger displacement plus 10 gal. (38 liters).

8-5.3 Hydraulic Safety Valve

Every hydraulic elevator must be equipped with a safety valve, installed directly adjacent to the hydraulic cylinder. For single cylinder designs, the safety valve must be attached to the cylinder with a connection that is threaded or bolted directly to the hydraulic cylinder. For dual cylinder designs, the safety valve must be located as close as possible and equidistant from both cylinders.

8-5.4 Hydraulic Oil Supply Piping & Fittings

8-5.4.1 Hydraulic oil supply line, from the hydraulic control valve to the hydraulic cylinder, must comply with the following:

- **a.** Schedule 80 piping must be installed from the hydraulic control valve to the hydraulic cylinder.
- **b.** All hydraulic oil supply line fittings that are located outside of the elevator machine room or hoistway must be of the welded type fitting. For all other fittings, threaded, welded, or rolled groove fittings may be utilized.
- **c.** Manual shut-off valves shall be provided in the elevator machine room and in the elevator hoistway pit. Shut-off valves must be full-flow, 1/4 turn ball valves.
- **d.** For in-ground hydraulic cylinder installations, a dielectric union or isolation coupling must be provided at each end of the hydraulic oil supply line.
- **e.** For all hydraulic supply piping, fittings, and valves, a minimum factor of safety of 5 must be utilized for calculating the required component pressure rating.

8-5.4.2 Hydraulic oil lines must remain in or under conditioned space from end to end and remain within the building footprint. For all buried hydraulic lines between machine room and hoistway, provide straight pipe run in PVC pipe sleeves. Inside diameter of the PVC must be a minimum of 4 inches (102 mm) larger than the outside diameter of the supply line fittings.

8-5.5 Hydraulic Oil Scavenger Pump

A scavenge oil reservoir with strainer and transfer pump must be provided for every hydraulic elevator. The scavenger pump unit must include a manual-reset pit flood switch to prevent pump operation if pit is flooded. Pump and reservoir must be anchored to the pit floor.

8-5.6 In-Ground Hydraulic Cylinder Protection

The exterior surface of in-ground hydraulic cylinders must be factory finished with a minimum 50 mils coating of either Applied Extruded Coating or Epoxy Resin.

8-5.6.1 In-Ground Hydraulic Cylinder Well Casing.

A dry, plumb, steel well casing must be provided for every in-ground cylinder assembly. The well casing must be located according to the elevator manufacturer's design. The

well casing must have a minimum ¼ inch (6 mm) thick wall and a welded 1/2 inch (10 mm) thick steel bottom.

8-5.6.2 In-Ground Hydraulic Cylinder PVC or HDPE Liner.
A Schedule 40 PVC or HDPE hydraulic cylinder liner must be provided for corrosion protection of the hydraulic cylinder and for containment of hydraulic fluid in the event of cylinder failure. The liner design and installation must comply with the following criteria:

- **a.** The liner must be sealed to the cylinder mounting flange. The connection of the liner to the cylinder must be designed to support the combined weight of the liner and any accumulated hydraulic fluid, to the full capacity of the installed liner.
- **b.** A ¼ inch (19 mm) diameter copper evacuation tube must be installed inside the liner, from the bottom of the liner to the cylinder mounting plate. The evacuation tube must be run through the cylinder mounting plate and extend a minimum of 6 inches (152 mm) above the plate. The evacuation tube must be fitted with a plastic dust cap.
- **c.** A metal pressure test manifold must be attached to the upper side of the cylinder mounting plate, for pressure testing of the liner and evacuation tube. The pressure test manifold must include a one-way, compressed-air inlet-valve and a 20 psi (138 kPag) safety relief valve.
- **d.** The complete system must be designed and built to withstand a pressure test of 30 psig (207 kPag). The pressure test must be performed after complete assembly and installation of liner, cylinder, and liner evacuation system.
- **e.** Gaps between casing, liner, and cylinder must be sealed with 4 inch thick (102 mm), 3,000 psi (21 MPa) grout. The top of the grout must be flush with the finish floor of the pit.

8-5.6.3 In-Ground Hydraulic Cylinder Liner Moisture Sensor System.
Moisture and oil sensors must be installed inside the cylinder liner for detection of oil and/or water at the bottom of the cylinder liner. The monitoring system controls and audible and visual alarms must be installed in the elevator machine room and must include separate visual alarms for water and for oil.

8-5.6.4 Cylinder Liner Pressure Test.
Following the complete assembly and installation of the cylinder/liner protection system, the entire assembly must be pressure tested to ensure the integrity of the fully sealed unit. For safety code compliance, periodic pressure testing is used to verify the integrity of the system. Comply with the following:

- **a.** Perform a 30 minute pressure test at the beginning of the Acceptance Test, when the hydraulic fluid as close as possible to ambient temperature.
- **b.** Perform a minimum 15 psig (104 kPag) pressure test of sealed system. For elevators with a travel greater than 30 feet (9.1 m), perform pressure test at 20 psig (138 kPag).
- **c.** Perform test from a remote location, outside of the elevator hoistway.
- **d.** Utilize an air pressure admission throttle and shut-off valve.
- **e.** Utilize additional pump unit safety relief valve set to relieve at 20 psig (138 kPag).

f. Utilize pressure gauge scaled for identification of 1 pound increments and calibrated at 0.5 percent accuracy.

g. Perform test in the presence of, and witnessed by, a NAVFAC Certified VTE Inspector.

8-5.7 Roped-Hydraulic Elevator Systems

For all hydraulic elevator designs, either an in-ground or holeless direct plunger hydraulic elevator must be utilized. Roped-hydraulic elevators must not be installed in Navy facilities.

EXCEPTION: In the event of compelling design conditions, the use of a roped-hydraulic elevator may be appropriate. Approval for use of a roped-hydraulic elevator design may be requested, on an individual project, by submission of a written Request for Approval to the NAVFAC VTE Program FEC Lead Certifying Official (LCO). The LCO is authorized to grant an exception to this restriction.

8-5.7.1 All roped-hydraulic plungers must be equipped with an over-travel limit switch. Limit switch must remove power from the hydraulic pumping unit and prevent the plunger stop ring from striking the head of the hydraulic cylinder.

8-5.7.2 All roped hydraulic elevators must have the following sign installed in the elevator MR:

"NOTICE: This is a Roped-Hydraulic Elevator. Emergency personnel shall not actuate the manual lowering valve. If movement of the elevator cab is necessary for extrication of passengers, contact the elevator service provider."

8-6 Elevator Performance Testing and Commissioning.

8-6.1 Performance Requirements

During the commissioning process, elevators must be inspected and tested for conformance to contract and safety code requirements and for performance and reliability.

8-6.1.1 Elevator speeds must be tested and recorded with the elevator running with no load, in both directions, and with rated load, in both directions. For each test to be considered successful, the elevator must run at a minimum of rated speed and at a maximum of 110% of rated speed.

8-6.1.2 Elevator performance and reliability must be tested by running the elevator, with rated load, for a continuous one-hour period. The elevator must run in both directions of travel, stop at each floor within 1/8 inch (3 mm) of level with the landing sill, and perform automatic door open and close operation. The requirements for Automatic Operation, Rated Speed, Leveling, Temperature Rise, and Motor Amperes must be met throughout the duration of the Endurance Test. The one-hour test period must be restarted from the beginning, following any shutdown or failure.

8-7 Elevator Supporting Documentation.

8-7.1 O&M Data Package

For all elevator construction and modernization, all shop drawings and product data material must be assembled into O&M Data Packages. Two complete hard copy data packages and two complete electronic data packages, on separate CDs, must be provided. Comprehensive computer diagnostic documentation and software shall be included in the electronic data packages.

8-7.2 Wiring Diagrams

For each controller, two complete sets of full size, as-built wiring diagrams must be provided. One set must be laminated and mounted in the elevator MR. In addition, two complete electronic sets of as-built wiring diagrams must be provided on separate CDs, in PDF format. Coded wiring diagrams are not acceptable unless fully identified.

8-7.3 Component Submittals

For each hydraulic component that is subject to hydraulic oil pressure, the product submittal package must include the component manufacturer's product data identifying the working pressure for hydraulic elevator use, factor of safety, and ultimate strength.

APPENDIX A: Design Reference Documents

Design elevator, hoistway, and machine room in accordance with this ITG and with the current versions of the following reference documents. The elevator design shall comply with the edition in effect at the time of contract award. This listing of references is not exclusive. If there are government or non-government standards, codes, or criteria documents that apply, they are applicable regardless of whether or not they are included in this list.

ABAAS - Architectural Barriers Act Accessibility Standard

ASME A17.1 - Safety Code for Elevators and Escalators
ASME A17.3 - Safety Code for Existing Elevators and Escalators
ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts
ASME QEI-1 - Standard for the Qualification of Elevator Inspectors

UFGS - 14 21 13.00 20 - "Electric Traction Freight Elevators"
UFGS - 14 21 23.00 20 - "Electric Traction Passenger Elevators"
UFGS - 14 24 13.00 20 - "Hydraulic Freight Elevators"
UFGS - 14 24 23.00 20 - "Hydraulic Passengers Elevators"

NFPA 70 - National Electric Code (NEC)

IBC - International Building Code
IPC - International Plumbing Code

SEI/ASCE 24-05 - Flood Resistance Design and Construction.

FEMA - 302, February 1999 - NEHRP Recommended Provisions for Seismic. Regulations for New Buildings and Other Structures. Part 1 Provisions.

Elevator Industry Field Employee Safety Handbook

National Elevator Industry, Inc. – Vertical Transportation Standards. Copies of this standard may be obtained from; National Elevator Industry, Inc., 400 Frank W. Burr Blvd., Teaneck, NJ 07666-6801; Telephone: (201) 928-2828.

UFC 3-310-04 - Seismic Design for Buildings
UFC 3-560-01 - Electrical Safety, O&M
UFC 3-600-01 - Fire Protection Engineering for Facilities
UFC 4-510-01 - Design: Medical Military Facilities

The design criteria provided in this Elevator Design Guide are applicable to both continental United States and overseas projects. However, some of the technical or commercial reference standards (ASME, NEC, ADAAG) that are listed in this document may be different for projects that are developed for NAVFAC EURAFSWA and NAVFAC Far East.

APPENDIX B: NAVFAC VTE PROGRAM CONTACTS

NAVFAC VTE Program Manager, Kevin P. Morse
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NAVFAC VTE Deputy Program Manager, Dale Hughes
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NAVFAC Facility Engineering Command (FEC) Lead Certifying Officials

A current listing of FEC LCOs may be found on the on the NAVFAC Portal, NAVFAC PW BMS B-15.12 Vertical Transportation Equipment, under the POCs (Point of Contact) tab.