8. Heavy Duty Transportation System Elevator Design Guidelines

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Abstract: This recommend practice contains guidelines for transit systems to use to specify heavy duty elevators with a rise of 40 feet or less.

Keywords: heavy duty elevators, low rise elevators, transit elevators

Introduction

(This introduction is not a part of APTA RT-EE-RP-002-03, *Heavy Duty Transportation System Elevator Design Guidelines>)*

The objective is to address the specific heavy duty elevator needs of North American Transportation Systems. This document is intended as a guideline of technical provisions for the design and construction of elevators which can provide safe, reliable service in the harsh, heavy usage, high abuse environment of Transportation systems.

This design guideline is not intended to be a 100%, procurement ready technical specification for all This design guideline is the result of the combined efforts of the members of the APTA Elevators and Escalators Technical Forum over the past several years. Membership of the Technical Forum includes Transportation systems, consultants, elevator and escalator component manufacturers transportation systems. Each Owner may find it necessary to make changes to suit their specific needs. However, the stringent provisions are the result of the members combined experiences and, in general, reflect Transportation requirements and the need for improved safety and reliability. There are also “comments” and “Notes to specifier” in the text to guide the user in preparation of a procurement specification document.

It is expected that some manufactures will be quick to tell us that these requirements will “add to the cost of the procurement”. We all know, from past experience, the high life cycle maintenance costs associated with the manufacturer’s “standard” product when used in a Transportation environment. Paying “more up front” will be more than compensated for by the overall reduced life cycle costs.

The Working Group has also established certain design parameters for elevators to be considered for transit applications as shown in table 1.

Table 1- Maximum Rise of Elevators per type in this document:

Elevator Type	Direct Plunger	Single stage holeless	Roped hydraulic	Rack and Pinion
Maximum Rise Note: for this document only	40 feet	16 feet	40 feet	40 feet

The working group does not recommend the use of telescoping hydraulic elevators in transportation applications.

To that end, as with the recently adopted Heavy Duty Escalator design guidelines, this Working Group recommends increasing the capacity of the elevators above and beyond that of the ASME A17.1 code required minimums. Table 2 shows the APTA rated minimum load recommendations above that of ASME A17.1 below should be incorporated into the design

decisions for all elevators in transportation applications.

Table 2- Elevator Platform Size vs. Rate Load changes

Platform Width (Ft)	Platform Front to Back (Ft.)	Inside net platform area.(Ft^2)	A17.1 Maximum inside net platform Area (Ft^2)	A17.1 Rated Min.	A17.1 Rated Nominal (Lbs.)	APTA Rated (Lbs.) @ 1.5 over A17.1 minimum
6.00	5.00	24.08	24.2	1993	2000	3000
7.00	5.00	28.33	29.1	2425	2500	3750
7.00	5.50	31.67	33.7	2781	3000	4500
7.00	6.17	36.11	38	3278	3500	5250
8.00	6.17	41.53	42.2	3920	4000	6000
6.00	8.83	45.81	46.2	4455	4500	6750
6.00	9.38	48.88	50	4853	5000	7500

Be sure to coordinate design of elevators with all applicable disciplines affected. This can include architectural, electrical, structural, HVAC as well as fire/life/safety designers.

The use of this guideline will provide improved availability and reliability of transportation elevators and, most importantly, will improve customer safety, satisfaction, and convenience. The results can only be an increase in the public's confidence in the Transportation system's ability to meet their needs, and thus, an increase in ridership.

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Contents

Heavy-Duty, Transportation System Elevators Design Guidelines

PART I GENERAL

1.01 General Description

This document provides design guidelines for the fabrication, installation, and testing of low rise (under 40 feet of travel) elevators intended for use in a public transportation environment

Note to specifier: This guideline has several elevator choices for this duty. Please note that care must be taken in specifying the proper sections for the elevator type selected.

1.02 Definitions

A. beneficial use: When the elevator is placed into service, may be prior to the site being ready for public use.

B. contractor: the general contractor

C. elevator: a hoisting and lowering mechanism, equipped with a car or platform, which moves in guide rails or racks and serves two or more landings and is classified by the following:

D. elevator, freight: an elevator used primarily for carrying freight and on which only the operator and the persons necessary for unloading and loading the freight are permitted to ride.

E. elevator, hydraulic: a power elevator where the energy is applied, by means of a liquid under pressure, in a hydraulic jack

F. elevator, passenger: an elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.

G. elevator, rack and pinion: a power elevator with or without a counterweight which is supported, raised, and lowered by a motor or motors which drive a pinion or pinions on a stationary rack mounted in the hoistway.

H. elevator, roped-hydraulic: a hydraulic elevator where the energy is applied by a roped-hydraulic driving machine

I. final acceptance: The point at which the owner accepts the elevator project as being complete including all submittal requirements. This may be a different point in time than substantial completion.

J. heavy duty elevator: An elevator designed specifically for transportation system usage.

K. installer: The responsible party who installs the elevator.

L. interim maintenance: Maintenance from the point of substantial completion, but prior to Revenue Service.

M. notice to proceed: Within this document shall mean the date which the elevator installer is notified to proceed with the project.

N. owner: owner in control of the facility.

O. revenue service: The station or facility opening date.

P. substantial completion: The point at which the elevator is ready for use, whether the site is finished or not. This is where the jurisdictional inspection usually takes place.

1.03 Temporary and Permanent Electrical Power Services

A. Temporary power for installation shall be made available to Contractor at the time of the installation. Permanent power shall be made available for testing. All power shall be provided at no cost to Contractor.

Note to specifier: close coordination with the electrical engineer is recommended to provide the proper power supply for a given installation. Additionally, coordination of power for HVAC, smoke detectors and sump pumps is required by the electrical designer.

B. For the elevator drive systems: 208, 220 or 480 volts, 3 phase, 3 wire, 60 Hertz terminating in a disconnect switch within sight of the controller.

C. For lighting and GFCI receptacles: 120 volts, 1 phase, 3 wire, 60 Hertz terminating at the elevator controller location.

D. Separate disconnect for cab lighting and wiring to cab.

E. Separate service for tank heaters and/or coolers and sill heaters where required.

1.04 Applicable Codes, Standards and Publications

Elevator designs and installations shall be heavy duty, and shall comply with the following.

A. American National Standards Institute (ANSI)

B. ASME Al7.1, A17.2.3, A17.5 applicable edition

Note to specifier: you must identify which edition of ASME A17.1 is applicable for your jurisdiction as different editions may affect procurement and installation

C. Canadian Standards Association, CSA B44

D. National Fire Protection Association (NFPA)

E. NFPA No. 130, "Fixed Guideway Transit and Passenger Rail Systems"

F. ANSI Cl, National Electric Code (NFPA 70)

G. Americans with Disabilities Act Accessibility Guidelines (ADAAG)

H. IEEE 519 Standard Practices and Requirements for Harmonic Control in Electrical Power Systems [Rack & Pinion only]

I. Canadian Welding Bureau (CWB)

J. American Welding Society (AWS)

K. American Society of Testing and Material (ASTM)

L. International Standards Organization, ISO 281/I-1997

M. American Federation of Bearing Manufacturers Association, AFBMA, Std. 9 and 11

N. Occupational Safety & Health Act (OSHA)

O. Any additional requirements imposed by local agencies shall be incorporated into elevator installations.

P. In case of a conflict between codes, regulations, or standards, the most stringent requirement shall take precedence.

1.05 Submittals

A. Product Data: Submit manufacturer's product data within four weeks of NTP for each system proposed for use. Include the following:

1. Electrical characteristics and connection requirements.

2. Expected heat dissipation of elevator equipment in machine room BTU based on 120 round trip cycles per hour.

3. Maintenance programs: within sixty (60) days after notice to proceed, and prior to installation, contractor shall submit detailed interim and revenue service maintenance programs, showing functions to be performed and their scheduled frequency.

4. Rack and pinion drive, rack and safety layouts.

5. Oil performance data sheets.

6. Coordinated delivery schedule.

7. Manufacturers recommended preventive maintenance plan, including interim maintenance procedures where applicable.

8. Pre-acceptance test forms.

B. Shop Drawings: Submit approval layout drawings to scale. Include the following:

1. Car, guide rails, buffers and other components in hoistway.

2. Maximum rail bracket spacing.

3. Maximum loads imposed on guide rails or racks requiring load transfer to building structure.

4. Loads on hoisting beams.

5. Clearances and travel of car runby

6. Clear inside hoistway and pit dimensions.

7. Location and sizes of access doors, hoistway entrances and frames.

8. Car and Hall fixtures.

9. Remote hydraulic piping layouts specific to each elevator.

10. Refuge space on top of car and pit.

11. Machine room and hoistway layout.

12. Signal and operating fixtures, operating panels and indicators.

13. Cab design, dimensions and layout.

14. Hoistway-door and frame details.

Note to specifier: (Optional specification for fast track projects:)

Shop drawings: Six (6) copies of the shop drawings (or cut sheets with standard dimensions if available) shall be provided by the Contractor for approval within three weeks of notice to proceed. All bearing ratings, identification and catalog numbers shall be provided.

1.06 Operating and Maintenance Manuals

A. Operating and Maintenance manuals

Prior to installation, installer shall submit three (3) preliminary sets of Operation and Maintenance manuals for approval six weeks after Notice To Proceed: After Owner approval and prior to the beginning of acceptance testing, six (6) sets of the approved manuals shall be provided by the installer. After approval and substantial completion, the final manuals are due no more than 30 days after any punch list items are completed. The manuals shall include the following:

1. Complete table of contents.

2. Complete instructions regarding operation and maintenance of equipment. Included will be complete illustrated, exploded views of all assemblies, and a complete, illustrated, exploded view for identifying all system parts.

3. Complete nomenclature, lead time and location of replaceable parts, OEM and installer part numbers, current cost, and source. If product source is another vendor, contractor shall include name and address of other vendor.

4. Copies of approved preventive maintenance plan.

5. Descriptions of safety devices.

6. Safety rules, tests, and procedures, including testing of all systems and subsystems.

7. Troubleshooting techniques.

8. Detailed lubrication and cleaning schedule indicating weekly, monthly, quarterly, semiannual, and annual lubrication; and a description of each lubrication point, lubrication type, and specification.

9. As-built drawings shall include:

    a) Control and schematic electrical wiring diagrams of controller, including wiring of safety devices to connections with remote indication and control panels for each elevator and group of elevators.

    b) Electrical layout showing placement of lighting, light switches, receptacles, light fixtures, disconnect switches, and convenience outlets in machinery room and pits.

    c) Complete detailed drawings and wiring diagram of elevator fault finding device and connection to annunciator panel.

    d) Electronic and hard copies of ladder diagrams, logic and program.

B. Certification:

1. The OEM shall provide to the owner, certification, that the owner of the elevator(s) shall be provided with copies of all documents related to maintenance, safety, operations, design changes, modifications, retrofits, etc., Which relate to any part, component, equipment, system, subsystem, or material and services applicable to the elevator provided.

2. All of the above referenced shall be provided by the installer as it pertains to the original installation through the end of the warranty period.

3. The referenced material shall be provided within thirty (30) days of publication or internal distribution by the OEM. The material, even if labeled PROPRIETARY, shall be delivered to the Owner without prejudice or delay and at no additional cost.

C. Electronic material:

Provide all material on CD-ROM in a format approved by the Owner.

Material Safety Data Sheets (MSDS) and product data sheets: Shall be submitted with an index listing each product, along with the application method of the product, approximate quantity of product per elevator, and the component the product is applied to or associated with. The contractor shall allow 6 (six) weeks for review of MSDS by the Owner.

1.07 Training

Note to specifier: Properties with a 3rd party maintenance contractor should not require as much time and training by the Contractor and can be reduced to 8 hours.

A. The Installer will provide 40 hours of local training for the Owner and his representatives in the proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at the time of failure in operation and other building emergencies. Train Owner personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Provide manuals for all material covered in the training program. This training will take place at the discretion of the Owner at any time prior to the end of the warranty period.

B. (OPTIONAL) Provide a 60 minute (minimum) CD video or DVD describing and demonstrating daily maintenance, emergency procedures and troubleshoot techniques for electrical and mechanical failures and malfunctions.

1.08 Quality Assurance

Note to specifier: it is the recommendation of this working group to tighten this part of the specification as much as job circumstances and local procurement regulations permit.

A. Manufacturer: Provide elevators manufactured by a firm with a minimum of 10 years experience in fabrication of elevators.

B. Installer: lead mechanics with a minimum of 10 years experience in installation of elevators . Documentation shall be required to document this requirement.

C. Regulatory Requirements: Elevator system design and installation shall comply with the version of ASME A17.1 in effect for this contract.

D. Permits and Inspections: Contractor to provide licenses and permits and perform required inspections and tests.

Note to specifier: The following section may be appropriate in order to inspect and observe construction methods that would be difficult or impossible to observe after installation is complete.

E. Regulatory agencies: elevator design, materials, construction clearances, workmanship, and tests shall conform to the requirements of the codes and regulations listed in part 1.04, APPLICABLE CODES, STANDARDS, AND PUBLICATIONS.

F. Welding: Welding shall be performed in accordance with the requirements of AWS or CWB Welders shall produce evidence of current certification by AWS or CWB.

G. Labeling: Every elevator controller shall be clearly marked permanently on the controller with rated load and speed, manufacturer serial number, and the designated Owner identification.

H. Requirements of Regulatory Agencies

1. Contractor shall obtain and pay for all necessary permits, and perform such tests as may be required for acceptance and approval of elevators by jurisdictional agencies.

2. Contractor shall notify the proper inspectors to witness required testing.

I. (Optional)Factory Visit

1. The contractor shall provide for the costs of up to three of the owner's representatives to visit the factory where the elevator is being manufactured.

2. The contractor shall not ship the elevator without the approval of the owner after the conclusion of the factory visit.

1.09 Delivery, Storage and Handling

Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the Contractor will be responsible to provide a proper and suitable storage area on or off the worksite.

1.10 Warranty

A. The acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall be one (1) year from the date of Beneficial Use. The warranty excludes ordinary wear and tear or improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

Note to specifier: section 1.10 B is an option for third party maintenance during the warranty period.

B. Interim maintenance is required between Beneficial Use and Revenue Service. This service will be performed according to the approved maintenance plan, with no extra charge for overtime required to return the elevator to service. Vandalism and acts beyond normal wear and tear are excluded.

C. Deliverables: Proof of interim maintenance: documents will be required prior to Final Acceptance.

1.11 Maintenance Service

A. The approved maintenance service consisting of regular examinations, adjustments and lubrication of the elevator equipment shall be provided by the elevator contractor for a period of 12 months after the elevator has been turned over for the Beneficial Use. This service shall not be subcontracted but shall be performed by the installer. All work shall be performed by competent employees during regular working hours of regular working days and shall include emergency 24-hour callback service at no extra cost. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

B. Deliverables: Proof of maintenance, documents and all as builts documents to complete the O&M manuals will be required prior to Final Acceptance.

1.12 Design Criteria

A. General

Elevators shall be designed with provisions for thermal expansion and contraction of complete elevator assemblies.

B. Operational Requirements

Hours of operation shall be considered as twenty-four (24) hours per day, seven (7) days per week.

C. Seismic zone:

The elevator shall be designed to comply with seismic zone 2 requirements of ASME A17.1 2000 regardless of edition of ASME A17.1 approved for this project. The sole exception to this requirement is where the owner has designed the structure for a more stringent seismic requirement.

D. Environmental Requirements

Note to specifier: Interior installations include facilities such as airports and controlled environments with no corrosive elements. Exterior installations should be used for all light rail, heavy rail, commuter rail and bus applications whether exposed to the weather or not.

1. General: Elevators shall be capable of operating with full-specified performance capability while exposed to the following climatic and environmental conditions.

2. Interior installations: Elevators shall be designed to operate in a temperature range of plus five (+5) to plus one hundred and twenty (+120) degrees Fahrenheit, dry bulb; and all conditions of relative humidity while exposed to airborne dust and debris.

3. Exterior installations: Elevators shall be designed to operate while exposed to the natural elements of weather, including sunlight, rain, slush, snow and ice; all conditions of relative humidity while exposed to salt, de-icing chemicals, airborne dust, and debris, and corrosive elements; and in a drybulb temperature range of minus twenty five (25) to plus one hundred and twenty (+120) degrees Fahrenheit

E. Bearings

1. Bearings: All machine and motor bearing housings shall be provided with a drilled, tapped and spot faced area in the vertical and axial axis to accommodate a transducer that a Fast Fourier Transform (FFT) analyzer requires. Permanently mount transducers on the drive bearings and run the wires into the controller to a panel with BNC connectors on the ends to accommodate the FFT analyzer.

2. Motor limit: rigid mount: .15 ips flex mount: .2 ips.

3. Bearings shall be rated for an AFBMA L10 life as specified, under a fluctuating bearing load. All bearings shall have basic dynamic load ratings.

F. Fasteners

1. Fasteners shall be compatible with materials being fastened.

2. Fasteners shall be furnished with self locking nuts or retaining rings (spring washers, toothed disks).

3. Fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistant metals being fastened.

Note to specifier: Ride quality information can be found in great detail in the National Elevator Industry Inc. Design guideline manual. APTA has adopted a milli-g requirement of 35 milli-g in each axis in a raw format. A95 is an average of the peak to peak readings of the raw data to weed out inequities in collecting data or in frequencies outside human perception.

G. Ride Quality

1. All elevators shall have a maximum decibel reading of 70 with the doors closed during a run in the up direction.

2. All elevators shall have a ride quality of;A95 raw 35 mill-g, peak to peak in the x, y and z axis during a full load run in the up direction.

3. The vibration readings shall be verified in the field with an EVA-625 (as manufactured by PMT, Inc. or approved equal) placed in the center of the cab floor.

H. Car Frame

No cantilevered car frames are permitted.

1.13 Job Conditions

A. Protection: During installations, and until elevator systems are fully operative, contractor shall make necessary provisions to protect systems from damage, deterioration, injury to pedestrians, the general public and environmental conditions.

B. Coordination Requirements

1. Alterations: Contractor shall coordinate any alterations required to accommodate elevators with the Owner.

2. Floor finish in cab: Contractor shall install cab flooring as specified.

3. Lock and key requirements: Contractor shall coordinate with the Owner.

4. Pit Drainage: Contractor shall coordinate location of sump pits, pumps, pipes and related wiring with elevator installer.

Note to specifier: Elevator code prohibits connections of elevator pit drains to sanitary lines. The Owner may need to address drainage issues related to hydraulic elevators and the inherent environmental conditions that may apply.

5. Rigging Plan: Contractor shall supply a rigging plan that is approved by the Owner..

6. Safety Training: Contractor shall attend appropriate safety training programs provided by the Owner at no extra cost.

7. Methodology: The contractor shall meet with the Owner and provide a written method of installation for approval.

8. Electrical: The installer shall coordinate with the contractor and appropriate trade in relation to CCTV, communications, smoke detectors, shunt trip breakers, CCTV, power and cab lighting requirements.

9. Construction schedule: Installer shall coordinate deliveries, installation and testing with the Contractor.

Part 2 PRODUCTS

Note to specifier: This portion of the guidelines will encompass both hydraulic and rack and pinion requirements. Most of this section is applicable to both elevator types. Particular sections dedicated to either type will be identified as HP for hydraulic and RP for rack and pinion. If no indication is present, that item is applicable to both types of elevator systems. This section will have both hydraulic and rack and pinion sections. Many are applicable to both. Any section specific to one design will be identified as to which elevator system. Unrelated sections should be deleted in the final bid document.

2.01 Acceptable Manufacturer

A. (HP) Provide hydraulic elevators as specified.

B. (RP) Provide rack and pinion elevators as specified.

2.02 Summary of Features

A. Elevator Number: 1

B. Elevator Use: Passenger

C. Contract Load, in pounds: as per contract drawings

D. Contract Speed, in FPM: not to exceed 100

Note to specifier: the minimum elevator speed should not be lower than that required to run the elevator the full length of travel in no more than 30 seconds.

E. Travel Distance: as per contract drawings

F. Serves: as per contract drawings

G. Number of Stops: as per contract drawings

H. Number of Openings: as per contract drawings

I. Machine Location: as per contract drawings

J. Machine Type: As specified

K. Car and Hoistway Door Size: as per contract drawings

L. Car and Hoistway Door Type: as per contract drawings

M. Car and Hoistway Door Operation: Power High-speed, heavy duty

N. (Minimum opening speed 3.0 FPS)

O. Hoistway Entrance: New, as specified.

P. Cab Enclosure: New, as specified.

Q. Door-Reversal Device: Non Contact door reversal device

R. Car Operating Panel: Stainless Steel with vandal resistant features

S. Car Position Indicator Stainless Steel with vandal resistant features

T. Car Direction Indicator Stainless Steel with vandal resistant features

U. Hall Call Stations: Single riser, stainless steel with vandal resistant buttons

V. Self-Leveling

W. Communication System: "Hands-Free"

X. Provide keyed switch in car operating panel or hall push button station as directed to shut down elevator

2.03 Machine Room Components

A. (HP)The hydraulic system shall be of compact design suitable for operation under the required working pressure, not to exceed 400 p.s.i. measured at the pump. The pump unit shall not be mounted in the hydraulic-fluid storage tank. The pump shall be driven with a one piece multi-groove V-belt. The direction valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a muffler and a low-pressure switch. Provide a single lever ball type shut-off valve in both the machine room and the elevator pit.

1. Included in the reservoir shall be an oil fill strainer with air filter and a self-cleaning strainer in the suction line.

2. The tank shall have a reserve capacity of not less than 10 gallon and sight glass with markings for minimum and maximum oil level.

B. (RP) MACHINE COMPONENTS: The rack and pinion drive shall consist of one or more power-driven rotating pinions and arranged to travel on a stationary rack(s) mounted on a supporting structure(s). The drive shall have a means to synchronize the power-driven rotating pinions when multiple and/or twin drives are provided.

C. (RP) MOTOR: The motor(s) shall be an alternating current, totally enclosed fan coiled TEFC reversible induction type designed for elevator service with high starting torque (minimum 225% of rated torque) and low starting current. The motors shall be designed to stand the severe loads encountered in elevator service and the windings shall have a minimum insulation

1. The motors shall be of the alternating current reversible induction type of a design adapted to the severe requirements of elevator service. Motor shall be capable of developing the required high starting torque (minimum 225%) with a low starting current, and shall be designed to stand the severe loads encountered in elevator service.

2. Insulation of all windings shall be impregnated and baked to prevent absorption of moisture and oil. The insulation resistance between motor frame and windings shall not be less than one megohm. The motor windings shall stand a dielectric test of twice the normal voltage plus 1000 RMS volts of 60_Hertz, alternating current for one minute.

3. Bearings shall be rated with an AFBMA L10 life of 200,000 hours and housed in an oil tight, dust proof case provided with a sight glass or dipstick method of determining oil level in the case. The case shall provide a convenient method of draining the oil.

4. Motor leads in the conduit box shall have the same insulation class as the windings. Motor lead wire shall be rated 125 C and shall be sized for 105 C at the motor nameplate amperes at 1.0 Power Factor per Electrical Apparatus Service Association (EASA) recommendations. Leads are to be numbered for clockwise rotation when facing opposite the shaft end.

D. (RP) BRAKE: The brake(s) shall be of the self adjusting fail-safe (springapplied and electrically released) type provided with an external manualbrake release and designed to meet the service factor demand of its intended use.

E. (RP) AUTOMATIC LUBRICATOR: An automatic electric lubricator shall be provided on the car roof to provide a means of maintaining sufficient lubricant on the rack and pinions during normal operation. The lubricator shall dispense grease when the lift travels in its upwards direction at intervals that are pre-set by the OEM.

Note to specifier: Rack and pinion elevators are not required to have a counterweight. There are times when this would benefit the Owner in terms of reducing motor size or improving ride quality. When adding a counterweight, there are options to be explored in terms of the overbalance ratio and its affect on emergency egress and hoistway size.

2.04 Controller

Note to specifier: remote monitoring is an important part of elevator installations in public transportation facilities. This document will provide elevators capable of connections to many transit SCADA systems. This document does not provide any design guidelines for remote monitoring beyond providing PLC controls for the elevators.

A. PLC-based controller shall be provided, governing starting and stopping, as well as preventing, damage to the motor from overload or excessive current. It shall automatically cut off the motor current and bring the car to rest in the event any of the safety devices are activated. The controller shall be mounted in a vented cabinet within the [HP] machine [RP] controller room. The controller shall utilize soft start characteristics.

(Optional) (RP) The controller shall be designed to operate automatically on standby power.

1. Selective Collective Operation: As defined by ASME A17.1.

2. (HP)Provide intermittent automatic operation, once every 3 hours through the entire run of the hoistway. Cycling shall be the full 24 hours each day throughout the year.

3. (HP) Low-oil control shall turn off the elevator if a low oil condition is detected.

B. (HP or RP)Provide a separate battery powered unit that senses loss of power. Battery shall be 12 volt minimum, sealed nickel cadmium or gel cell construction. When loss of power occurs, elevator shall descend to lowest landing and open doors automatically. After a predetermined time, the doors shall close and the elevator shall remain inoperative until normal power is restored. The door open and alarm buttons shall operate under battery power.

C. (Option) Tank Heater: Provide a reinforced overhead oil reservoir with a tight fitting tank cover over the oil pump unit. The tank shall have a removable thermostatically controlled 500W screwed on heater.

D. (Option) Tank Cooler: Cooling unit Specifications:

1. Heat removal: to comply with section 1.05.A.2

2. Adjustable thermostat control

3. 10 micron filter

4. Must be capable of remote installation

E. Hydraulic piping: All piping shall use a minimum of schedule 80 pipe. No victaulic fittings are permitted. All buried piping shall be welded and left uncovered until accepted and approved by the Owner.

2.05 Hydraulic Plunger [*Select the following for holeless hydraulic elevators only*]

A. (HP) Hydraulic Plunger: Two accurately ground and polished hydraulic single stage plungers shall be provided. The bottom of each shall be fitted with a positive stop designed to prevent the plungers from leaving their cylinders. The top of each plunger shall be fastened to the car frame.

B. Hydraulic Cylinder: Two hydraulic cylinders designed to stand upright on the pit floor, on either side of the car, shall be provided. Each cylinder shall be constructed from steel pipe with a machined steel flange at the upper end and a heavy steel bulkhead at the lower end. Each cylinder shall be connected to the oil line. A packing gland with guide bearing, wiper ring and packing especially designed for hydraulic elevator service shall be mounted at the top of each cylinder along with an oil collector ring and drain hole. Each cylinder shall be finished with a coat of rust-inhibiting air-dry enamel and have an air bleeder valve and oil drain plug positioned above the pit floor. The plunger surface shall be a minimum of 20 micro- inches RMS and shall not exceed 35 micro-inches RMS for the entire plunger length in engagement with the cylinder seals. The plunger seals shall be urethane cup design with integral wipers or approved equal.

Note to specifier: consideration of the temperature of the environment for which the machinery and piping will be subject to. Some locations with severe temperature ranges may require both heaters and coolers for the hydraulic elevator system. Piping layouts also can affect the temperature of the hydraulic oil and must be considered when deciding on the final design.

2.06 Safety Devices

(HP) Provide a pipe rupture valve on the main cylinder line in the pit.

2.07 Jack Hole and Casing (for Hole-Type Elevator only):

A. The jack hole shall be drilled by using a rotary drill. No hammer drilling or blasting shall be allowed. The hole shall be located within 1-inch of the approved shop drawing location.

B. A Schedule 80 steel drill casing shall be provided. The drill casing shall be installed plumb so that the hydraulic jack can be installed perfectly plumb.

C. Prior to the installation of the drill casing, the Contractor shall submit a drawing showing the details of installation of hydraulic jack unit inside of the drill casing for approval. The drawing shall show all dimensions of the hydraulic jack, PVC liner, sand fill, drill casing, all couplings and the details for securing the PVC liner to the elevator pit.

2.08 Hydraulic Jack Unit

A. It shall be of sufficient size to lift the gross load to the height specified at the rated oil pressure and speed, and be factory tested to ensure adequate strength and freedom from leakage. No brittle material, such as gray cast iron, shall be used in the jack construction. All pipe sections shall be secured to each other with threaded connections.

B. The jack shall consist of the following parts: a non telescoping plunger of heavy seamless steel tubing accurately turned and polished; a stop ring electrically welded to the plunger to positively prevent plunger leaving its cylinder; an internal babbitt-lined, guide bearing; packing or seal of suitable design and quality; a drip ring around cylinder top; a cylinder made of steel pipes and provided with a pipe connection, air bleeder valve and oil drain plugs all positioned above the pit floor. The cylinder shall be furnished at the bottom with a safety bulkhead with an orifice to limit the speed of the car's descent to 15 feet per minute in the event that the outer case fails. Weld brackets to the cylinder for supporting the jack on pit channels. A platen plate shall be mounted with neoprene rubber sound dampeners designed to isolate the platen plate from the car frame with a safety factor of four.

C. The jack shall be provided with a caged primary seal and secondary seal so that weep oil can be drained via tubing to the scavenger pump tank.

D. If the jack must be supplied in Sections, the Sections shall be threaded. The cylinder shall also be welded and then polished at the threaded joint. The joints shall have any pipe coatings reapplied as per manufacturer's Specifications.

2.09 Hole Type Jacks

A. The jack shall be fabricated with an integral sleeve for connection to the PVC liner. The interstitial space between the PVC liner and the jack shall be capable of being monitored by a port on the pit plate.

B. The complete outer cylinder shall be waterproofed with a factory applied extruded pipe coating to protect the casing from corrosion. The pipe coating shall consist of 10 mills of Butyl Rubber or approved equal adhesive and 40 mils of heat applied polyethylene over coating. The coated pipe shall be protected during shipment with sheet steel wrap. The jack unit shall be installed accurately centered and plumb.

C. Install the jack unit in separate PVC outer liner constructed from Schedule 80 PVC pipe. The liner shall have a dished seamless bottom, a water stop ring attached to the liner and embedded in the pit floor, and sealed joints to prevent moisture seeping into the annular space between the liner and cylinder. The top of the liner shall be attached to the integral sleeve on the hydraulic jack.

D. For the drill casing, (See Structural Contract Drawings and Paragraph 2.12, Jack Hole and Casing).

E. After centering jack unit, affix it to the pit channels. Use stainless steel shims to level the pit channels. Fill the space between the steel casing and the PVC liner with clean dry sand to maintain plumbness and support PVC liner.

2.10 Roped Hydraulic Elevators

A. Rotating sheave to be mounted to fixed shaft through ball or roller bearings. Sheave support base to be attached to top of plunder with single 1-1/4" UNC bolt. Adjustable rope retainers shall be provided over the full 180 degree arc of contact. Sheave to be supported by two rails through cast aluminum slipper guides with removable UHMW polyethylene gibs. Suspension ropes and connections shall comply with ANSI A17.1-2000, Section 2.20. Ropes to be pre-stretched 8x19 construction with independent wire rope core. Shackles to be of the wedge rope socket type. A manually reset switch shall remove power from the driving motor and control valve should any rope become slack.

B. GOVERNOR AND SAFETY: supply as required by code. No remote testing of the safety is permitted.

C. Cylinder Mounting Assembly.

1. Base of cylinder to be elevated above pit floor by a pedestal weldment, including : (1) dead-end hitch plate for pit shackles, and (2) mounting surface for slack rope switch.

2. Pedestal and cylinder to be secured to wall by a steel bracket around the full 360 degree circumference, to fasten to the wall mounting surface with two horizontally spaced bolts, and adjustable for widthwise, depthwise, and vertical adjustment.

D. Cylinder

The cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure per section 2.1. The top of the cylinder shall be equipped with a cylinder head with drip ring and self-adjusting packing. The plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. The plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. The plunger and cylinder shall be installed plumb and must operate freely with minimum friction.

E. Oil Line Support Stands

Oil line support stands shall be supported with an adequate number of support stands. Stands shall be anchored to the floor or wall and adjustable in height. Rubber isolation clamps shall secure the oil line to the stand around the full 360-degree circumference.

F. Low Pressure Switch: low pressure switch to be pre-installed to valve.

2.11 Hoistway

A. (RP) Racks: zinc plated steel elevator guide supports shall be furnished to guide and support the car and counterweight (when provided), erected plumb and securely fastened to the building structure at the top, bottom and intermediate locations in coordination with the Owner. The fastening to the building shall have isolation pads to absorb vibration.

B. Roller Guides: Roller guides shall be mounted on top and bottom of the car frames to engage the racks (RP) or guide rails (HP).

C. (RP) Counterweight Rope (when supplied): The counterweight ropes shall be steel of size, construction and number to insure operation of the elevator and give satisfactory wearing qualities.

2.12 Rack and Pinion Drive System:

A. Variable Voltage Variable Frequency (VVVF) Motor Drive: provide new motor drives as follows:

1. The drive shall be capable of varying the torque on the motor during acceleration and deceleration.

2. The drive shall be capable of on-site programming the volts per Hertz, acceleration and deceleration ride profiles to adjust the ride quality due to drive control characteristics.

3. The flux vector drive shall control AC induction motors through the use of a high resolution, dual channel optical encoder.

4. The flux vector drive shall be capable of delivering 100% rated motor torque from base speed down to zero speed.

5. The flux vector drive shall not use DC injection for slowdown braking.

6. The flux vector drive shall be adjusted to achieve the required current, motor voltage and frequency so as to match the characteristics of the hoist motor.

7. The drive shall not create excessive audible noise in the elevator motor.

8. The drive shall be capable of delivering sufficient current to accelerate the elevator to contract speed at the rated load. The drive shall provide speed regulation within 5% during all phases of acceleration, deceleration and leveling.

9. A contactor shall disconnect the hoist motor from the drive’s output each time the elevator stops. If the contactor has not returned to the de-energized state when the elevator stops, the elevator shall not restart.

10. Maximum total harmonic distortion shall not exceed IEEE Std. 519 to be measured at the elevator disconnect.

Note to specifier: There are two main types of VVVF drives now available; regenerative and non regenerative. While the regenerative is more expensive, the BTU output is almost half that of a non-regenerative system which absorbs the regenerative energy into a resistor bank.

B. (HP)Car Guide Rails: Tee-section steel rails with brackets and fasteners.

C. Buffer: as per code.

2.13 Wiring--Conduit and Wiring Cables and Conductors

Note to specifier: All wiring should be rated one size over the NEC table requirements for conductors. All internal elevator locations should use NFPA ratings for damp conditions, while outdoor locations should be rated for wet locations. Indoor installations with a high water table should be rated for wet locations.

A. Conduits

1. Unless otherwise specified, all electrical conductors in the pits and hoistways, except traveling cable connections to the car shall be provided in rigid steel conduit with steel outlet boxes, except that a small amount of flexible conduit may be used where conduit is not subject to moisture or embedded in concrete

2. Rigid steel conduit shall be full weight, threaded, hot-dip galvanized, inside enameled, conforming to ANSI C80.1.

3. Conduit fittings and bodies shall meet ANSI/NEMA FB 1; threaded type, material to match conduit.

4. Terminal boxes, pull boxes and other similar items, shall be of approved construction, thoroughly reinforced, and shall meet ANSI/NEMA FB 1.

5. All electrical boxes exceeding 150 cubic inches shall be supported independently of the conduits.

6. All raceways shall be threaded rigid steel conduit complying with ANSI/NEMA FB 1.

7. Where permitted flexible heavy-duty service cord, type SO, may be used between fixed car wiring and switches on car doors for safety edges and light ray devices for reversal devices.

8. Where permitted, flexible metal conduit shall be fabricated in continuous length from galvanized steel strip, spirally wound and formed to provide an interlocking design with a gray XLPO Thermoset Type 2 outerjacket.

9. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. If the bushings are constructed completely of insulation material, a steel locknut shall be installed under the bushing. At ends of conduits not terminating in steel cabinets or boxes, the conductors shall be protected by terminal fittings having an insulated opening for the conductors.

10. All conduits terminating in NEMA 4X boxes shall be backed up with flat rust resistant steel plates to fit the entire area where the conduit penetrated the box.

11. All conduit fittings and connections shall be compression type. The use of set screw or indentations as a means of attachment is not permitted.

12. Connect motors and other components subject to movement or vibration, to the conduit systems with flexible conduit.

13. The Contractor shall furnish all materials and completely wire all parts of the electrical equipment of the elevators including electrical devices on hatch doors. All car wiring and conduit shall be replaced with new including car junction boxes.

14. All solid state and electrical components located on top of the car enclosure or in the hoistway shall be installed within NEMA 4X enclosures.

15. Conduits shall be brought and connected to suitable approved connection boxes at all outlets, apparatus and panels.

16. Conduit Sizing, Arrangement, And Support

    a) Size conduit per NEC for conductor type installed or for Type THW conductors, whichever is larger; 3/4-inch minimum size for conduit.

    b) Conduits for small devices such as door switches, interlocks, etc. shall be permitted at ½ inch

    c) The total overall cross sectional area of the wires contained in any conduit shall not exceed 40 percent of the internal area of the conduit.

    d) Arrange conduit to maintain headroom and present a neat appearance.

    e) Route exposed conduit parallel and perpendicular to walls and adjacent piping

f) Maintain minimum 6-inch clearance between conduit and piping. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

g) Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

h) Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit on racks.

i) Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

j) No conduit shall be attached to a cable tray or installed within 6 inches of a cable tray or light fitting except for termination.

k) Approved strain boxes shall be installed for all vertical runs in accordance with Code.

17. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL listed through penetration firestop system to maintain wall or floor rating.

18. All interlock, hall button and limit switch branch wiring shall be enclosed in flexible steel conduit with covering of liquid tight Type "EF" with connectors having nylon insulated throat.

19. All screws used for terminal connections of all wiring (machine room, hoistway and pit) shall be provided with "star washers" of proper size and type.

20. All existing conduit and wiring shall be removed and wall/floor slabs patched with fire rated material.

C. Conductors

1. Unless otherwise specified, conductors, exclusive of traveling cables, shall be 98% conductivity copper, solid, for size 10 AWG and smaller, and stranded for size 8 AWG and larger shall be stranded or solid coated annealed copper in accordance with the NEC for Type THHW.

2. Where 16 and 18 AWG are permitted by Code, either single conductor cable in accordance with Code for Type TF, or multiple conductor cable may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant.

3. Insulation Voltage Rating: 600 volts.

4. Insulation: ANSI/NFPA 70, type THHN/THWN, XHHW or THW.

5. The use of PVC insulation shall not be permitted.

6. Color Coding: All power conductors identified as to phase and voltage by means of color impregnated insulation, as follows:

	Voltage	ØA	ØB	ØC	Neutral	Ground
8.	120/208V	Black	Red	Blue	White	Green
9.	277/480V	Brown	Orange	Yellow	White	Green

10. For wire sizes No. 8 AWG and larger, color banding tape, minimum 2 inches wide, may be used at all accessible locations in lieu of colored insulation.

11. Multiple conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control boards shall be in accordance with Code.

12. No joints or splices shall be permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

13. All wiring shall test free from short circuits or grounds. Insulation resistance between individual external conductors and between conductors and ground shall be not less than one meg-ohm.

14. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by Code.

15. Equipment grounding shall be furnished and installed. Ground conduits, supports, controller enclosures, motors, platform and car frames, and all other non-current conducting metal enclosures for electrical equipment in accordance with Code. The ground wires shall be copper, green, insulated and sized as required.

16. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Code. The Contractor may at his option make these terminal connections on No. 10 or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

17. Provide all necessary conduit and wiring between all remote machine room and hoistway.

C. Traveling Cables

1. Traveling cables from junction box on car to junction box in hoistway shall consist of flexible traveling cables conforming to the requirements of Code.

2. Junction boxes in hoistway and on car shall be equipped with terminal blocks. All connections to terminal blocks shall be made with either terminal eyelet connections or pressure wire connectors of the clamp type that meet UL 486 requirements for stranded wire.

3. Terminal blocks shall have permanent indelible identifying numbers for each connection. The outer covering must remain intact between junction boxes. Abrupt bending or twisting producing distortion of cable is not permitted.

4. Cables shall be free from any possible contact with hoistway structure, car or other equipment. Furnish and install shields or pads to protect the cables.

5. Travel cables shall include, as a minimum:

   NOTE TO SPECIFIER – COORDINATE TRAVELLING CABLE REQUIREMENTS VITH OWNERS SECURITY REQUIREMENTS IE CARD READERS, CAMERAS , ETC

   a) 2 coaxial cables shielded for the CCTV system.

   b) 4 cat 5 twisted shielded pairs for security and telephone systems

6. Provide 10 percent but not less than 2 spare conductors in each traveling cable.

7. Provide separate traveling cables for car lighting and fan control circuits.

8. Provide traveling cable for telephone in the elevator car. Cable shall extend from junction box in hoistway to telephone box in car.

9. Provide traveling cable for car work lights. Cable shall extend from junction box in hoistway to car junction box.

10. Car and hoistway junction boxes shall be provided for on the top of the elevator cab.

11. Cables shall include ten percent spare wires between each controller, selector, and hoistway junction box, all spares to be properly tagged or otherwise identified with clear and indelible markings.

12. All insulated wiring, control wiring and wiring in traveling cables shall be tag coded at their terminals in the motor room, and hoistway junction box, elevator cab junction box, and push-button stations within the cab, and shall agree with the approved wiring diagrams.

13. The traveling cable shall be wired directly from the controller to the elevator with no hoistway junction box.

14. The emergency stop switch in the car shall be connected to all alarm bells in a manner that will cause the bells to ring when the emergency stop switch is in the "On" position.

D. Motor Circuits:

1. Contacts in elevator motor circuits that are to be opened by governors or other safety devices shall be copper to carbon or other approved of the non-fusing type. Contacts on control and signal relays and switches shall be commercially pure silver. Contacts on switches breaking heavy motor circuits shall be copper to carbon or, if of metal, shall have supplementary breaking contacts and shall operate with suitable wiping action, or shall be of approved equivalent design and construction. They shall be equipped with suitable blowout coils, vanes, barriers, etc., where necessary to prevent undue arcing and heating.

2. Car and hall operating signal circuits shall be not exceed 48 volts.

3. Each major component of equipment shall have the manufacturers name, type, class or catalog number on a metal plate securely attached to the item of equipment in a conspicuous location.

4. All cabinets containing motor drives, filter boxes, transformers and power reactors shall be supported on rails and isolated from the base building structure with elastomer pads having a minimum static deflection of 3/8" (Mason Type N, or equivalent). All connections to and from the cabinetry shall be flexible in order not to compromise the isolation system. Use non-rigid conduit for the final electrical connection, with all other conduit supports and clamps provided on a neoprene sponge insert.
   Note to specifier: Careful coordination with other engineering disciplines is required to assure proper grounding methods are followed in the elevator machine room as well as proper steps to reduce noise on VFAC elevator drive systems.

5. Supply, installation and connections of fused main line disconnect switch of the lockable type for the elevators in the machine rooms.

6. Signal to the controller in the machine room to indicate special emergency condition due to lobby smoke detector activation; and smoke detectors in the elevator lobby and machine room in accordance with the ASME A17.1 code. Furnish and install means to automatically disconnect the main line power supply to the elevator prior to the application of water.

7. Car lighting and fan circuit for the elevators shall be located in circuit breaker panel in the machine rooms.

8. Permanent light fixtures with switches and duplex-grounded receptacles in the elevator machine room and elevator pit. Receptacles in the pit shall be ground fault circuit interrupter type.

Note to specifier: Careful coordination with other engineering disciplines is required to assure proper grounding methods are followed in the elevator machine room or controller locations as well as proper steps to reduce noise on VFAC elevator drive systems.

2.14 CAB ENCLOSURE

Note to specifier: Cab finishes are typically designed by an architect. This section provides the cab shell, cab front, floor and dome only. The final cab finishes should be detailed in the bid drawings developed in coordination between the architect and the elevator designer. This guideline is focused on key items for materials and finishes.

Plan on stainless steel type 316 #4 or hairline finish with vertical grain as a minimum for all stainless steel.

Poured epoxy floors are recommended above tile or diamond plate flooring.

Although an elevator car sized to fit a gurney or emergency stretcher is not required by A17.1, it may be a requirement of the Local Governing Code and is recommended for consideration.

Where fire-rated shaft construction is required for an elevator hoist way, the Car enclosure shall be solid on all sides.

Where solid shaft construction is not required, the hoist way and the Car enclosures may be partially glass. An observation Car may have glass on a minimum of one wall or a maximum of three walls including glass entry Car doors or doors with vision panels.

The glass observation panels should be operable, opening into the car so that the panels can be cleaned and access is provided for cleaning the hoist way glass panels from within the car. A17.1 Code requirements include the following, which must be reviewed by the designer:

A stationary panel must be 3'-6" in height below the panel that opens, the open panel must have locks and safety shutoff feature as required by Code and a handrail must be at each glass observation panel. The designer must coordinate with the car manufacturer and establish that the operating panel size of 9/16" glass does not exceed the limitations of the hinges used.

A. Cab configuration and materials shall be as per contract drawings prepared by the architect and as specified herein.

B. Cab Flooring:

1. Appropriate floor materials include:

2. Chemical Resistant Urethane

3. Terrazzo with Marble Chips in Epoxy

4. Clear Epoxy Resin with Vinyl Chips

C. Seamless and resilient elevator cab flooring shall be poured or laid in accordance with manufacturer's instructions over a minimum of one 3/4" thick marine grade tongue in groove plywood substrate.

D. Resilient flooring systems shall be self-extinguishing, have 200° F. heat resistance, 11,700 PSI compressive strength, 2,200 PSI tensile strength, and 5,000 PSI flexural strength.

2.15 CEILING TYPE

A. The clear height under the ceiling canopy shall be a minimum of 8'-0". Ceiling canopies shall be stainless or enameled steel not less than 0.109" nominal thickness.

Note to the Specifier: It cove lighting is used at non-entry walls the underside and return of the cove shall be12-gauge type 316 stainless steel, #4 brushed finish with grain running the direction of the cove. Each corner of the cove shall be reinforced with hangers same gauge as the cove. A vandal resistant lens cover shall be placed between the cove return and ceiling.

B. Ventilation: 2-speed exhaust fan. Finish and material of fan enclosure and blade shall match the finish and material of the ceiling having a NEMA 4X rating. Exhaust blowers shall be designed with a hood.

Note to Specifier: The material selection, type, pattern and finish requires careful consideration for durability, ease of maintenance and appearance for Finished Solid Enclosures.

M Materials and finishes for exposed parts of elevator car enclosures shall include:

a. Satin Stainless Steel: ASTM A 666, Type 316, with Hairline Vertical satin finish.

b. Textured Stainless Steel: ASTM A 666, Type 316; titanium nitride or oxide colored; with coined or embossed texture rolled into exposed surface. Surface may be satin polished, satin relieved, color coated and satin relieved or color coated and bright relieved after rolling.

Note to specifier: Textured stainless steel products may be used particularly where there is no or little exposure to deicing or coastal salt. Crevice corrosion can be a significant problem in coastal areas. It is advisable to use textured stainless steel above wainscoting, not below where moisture and salts will cause corrosion.

Nickel Silver Extrusions: ASTM B 151 (ASTM B 151M), alloy UNS No. C74500.

2. The desired thickness of stainless steel should always be shown in inches. ASTM

does not define stainless steel gauges and each producer has their own definition. The specifier will have no legal protection if a gauge number is specified and the thickness is not what was desired. List a minimal thickness or a nominal thickness with an acceptable tolerance variation. The nominal thickness typically associated with 12 and 14 gauges are as follows:
12 gauge - 0.109 inches (nominal)
14 gauge - 0.078 inches (nominal)

3. Most stainless steel finishes with an obvious grain are directional. If all the panels are not installed in the same rolling or polishing direction, there will be color variation from panel to panel.

Observation Cars

1. Where glazing is used, safety-glazing material must be specified in accordance with ANSI Z97.1. These are defined as glazing constructed, treated or combined with other materials to minimize cutting and piercing injuries when broken by human contact. The following when in compliance with ASME A17.1 and Z97.1 may be used:

a. Laminated Glass: Two or more sheets of glass held together by an interlayer(s) of plastic material.

b. Tempered Glass: A single sheet of specially heat or chemically treated glass which cannot be cut, drilled, milled or polished after treatment.

c. Wired Glass: A single sheet of glass with wire completely embedded in it.

d. Safety Plastic: A single or multiple sheets laminated of synthetic plastic in the form of fibers or flakes which are poured and molded and which contain an organic substance of large molecular weight.

e. Organic Coated Glass: A single sheet of glass with an applied organic coating (plastic) on one or both sides.

f. Safety Insulating: Two or more sheets of glazing separated by air space as a complete assembly.

2. Where enclosures include panels of glass, transparent or translucent plastic, they shall be a minimum 9/16" thick laminated glass complying with 16 CFR Part 1201.1, 1201.2; laminated or safety glass or plastic complying with CAN/CGSB-12.1.

2.16 HANDRAIL TYPE

Handrails: 1-½ inches outside diameter type 316 stainless steel #4 brushed finish and wall connectors shall have security type fastenings and shall be the same material and finish as the handrail. Handrail height shall confirm with Code requirements placed on non-entry walls.

2.17 HOISTWAY EQUIPMENT

A. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of 2 mm type 316 stainless steel. Provide an additional type 316 stainless steel sill angle support. The sill shall be type 316 stainless steel.

B. Doors: Entrance doors shall be of hollow metal construction with vertical internal channel reinforcements. Panels front and rear, framing, operating levers, and integral hardware shall be type 316 stainless steel; panel shall be 2mm and have a No. 4 finish.

C. Entrance Finish: Finish shall be type 316 stainless steel #4 finish.

D. Sight Guards: type 316 stainless steel

E. Car Frame: A suitable car frame shall be provided with adequate bracing to support the platform and car enclosure. The buffer striking plate on the underside of the car-frame platform assembly must fully compress the spring buffer mounted in the pit before the plunger reaches its lower limit of travel. Provide welded or bolted ASTM 123 galvanized or type 316 stainless steel channel uprights affixed to crosshead and plank channels with welded or bolted bracing members and gusset plates which will remove strain from car enclosure.

F. Platform, Heavy Loading Type: The car platform shall be arranged to accommodate one-piece loads weighing up to 25% of the rated load, such as wheeled food carts, hand trucks, etc. The platform shall be type 316 stainless steel.

G. Provide a sill mounted closer at all landings.

Note to specifier: hoistway facia can be avoided be recessing the hoistway landing sills, or if ASME A17.1 2000 rules apply by providing a door lock on the car door.

2.18 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car-Operating Panel: A type 316 stainless steel #4 vertical finish panel shall be provided with vandal resistant push buttons designed to bottom out against the panel plate and not the contacts, key switches.

B. Provide one car operating panel integral with a stationary return panel.

C. Braille/Arabic designations shall be flush with inconspicuous mechanical mounting.

D. Provide a service cabinet with a locked flush hinged or sliding door and integral certificate frame. Certificate Frame shall have durable Plexiglas window and be accessible from backside of locked door. Minimum window size to be approved by the Owner. Cabinet shall contain the following key type controls:

1. A light switch.
2. Two speed fan switch.
3. Inspection switch, conforming with the Code.
4. Independent service switch.
5. A duplex 120 volt, A.C. GFI convenience outlet.
6. Emergency Stop switch.

E. Engrave the car operating panels with the following:

1. No Smoking. Minimum 1" high lettering and graphic symbol
2. Elevator Number over operating buttons. Minimum 1/4" high lettering.
3. Elevator Capacity. Minimum 1/4" high lettering.
4. Firefighters Operating Instructions. Minimum 1/8 inch high lettering.

F. Car Position Indicator: A vandal resistant car position indicator shall be provided integral with the car operating panel.

Note to specifier: ADA requires 2 way communication between the cab and the outside world. ASME A17.1 also requires communication between remote machine rooms and the elevator cab. This can mean at times that there are two modes of communication in the elevator cab.

G. Communication: A hands free communication device shall be provided which has been designed in response to ADAAG requirements.

H. Car Lantern and Chime: A stainless steel vandal resistant directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and an adjustable electronic chime will sound.

I. Hall Fixtures: Hall fixtures shall be provided with necessary stainless steel vandal resistant push buttons and key switches for elevator operation. Raised markings shall be provided for each push-button

J. Landing Passing Signal: An adjustable electronic chime bell shall sound in the car to tell a passenger that the car is either stopping at or passing a floor served by the elevator.

2.19 Door Operator Equipment

A. Provide a GAL MOVFR-HSL or equal door operator with encoderless VVVF drive and the following features:

1. ½ hp motor and heavy duty sprocket, chain, belt, and sheaves.

2. Closed loop regulated speed performance.

3. Hand-held keypad programming.

4. Adjustments can be stored in the keypad and downloaded to another operator.

5. Adjustable door obstruction reversal.

6. Optical cams with LED indicators.

7. Test switches for open, close, nudging and speed zone set up.

8. Universal inputs for open, close, and nudging.

9. Reversing switch to back up the door reversal device.

B. Provide a non contact door reversal device with light immunity: The Door Reopening Device shall cause both the car and hoistway doors to reverse, should they detect an obstruction in the elevator entrance and shall be , Tri-Tronics, “”W” Series Door Edge, or approved equal. The device electrical wiring shall be supplied with quick disconnects terminals to facilitate replacement. The infrared curtain detector shall include the following:

1. A protective infrared detector field extending from 1 1/2” above the car sill to a height of 68”.

2. A fail-safe control system to prevent the doors from closing in case of power loss to the detector.

3. A one-piece full door height protective lens cover designed to be completely waterproof and to withstand impact, abrasion and vandalism.

PART 3 EXECUTION

3.01 Installation

Contractor shall install complete and operating elevators in accordance with OEM's instruction and approved shop drawings.

Note to specifier: clear instructions must be spelled out in the general terms and conditions relating to the installer being ready for the inspection, as well as the Owner being ready for items such as emergency power testing, fire alarm and smoke detector testing and communications. Special consideration should be given to AHJ lead times to schedule acceptance tests.

3.02 FIELD TESTING:

A. General

1. Contractor shall notify the Owner seven (7) days prior to each scheduled test contractor shall perform testing in the presence of an Owner representative.

2. Contractor shall notify the appropriate local authorities having jurisdiction a minimum of seven (7) days in advance of final acceptance tests.

3. Contractor shall provide all instruments, materials, and labor required for tests specified herein.

4. Contractor shall pre-test all devices within his control and provide documentation to prove compliance prior to jurisdictional inspection.

B. Acceptance testing requirements: Testing shall be performed in accordance with ASME A17.2.1 (for Rack and Pinion) or ASME A17.2.2 (hydraulic) procedures with the following additions or adaptations.

C. Test Period: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.

D. Speed Load Tests: The actual speed of the elevator car shall be determined in both directions of travel with full contract load and with no load in the elevator car. Speed shall be determined by a tachometer. The actual measured speed of elevator car with full load shall be within 10% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.

E. Post Acceptance Inspection: After the elevator is accepted by the local jurisdiction, a second inspection will be conducted (without weights) to determine specification compliance above and beyond the code requirements of the acceptance inspection.

3.03 Reinspection:

If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform with the requirements of the contract specifications or the Safety Code, no approval or acceptance of elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected, the Owner shall be notified and the elevator will be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

Note to specifier: Consider a Reinspection Penalty in addition to any additional fees imposed by the AHJ for repeated inspections. Significant liquidated damages should be considered if any punch list items are not completed within one follow up inspection, the contractor should be back charged $1,000 per reinspection.

3.04 ADJUSTING AND CLEANING

A. All equipment shall be adjusted prior to final testing and acceptance.

B. Paint exposed work soiled or damaged during installation.

END OF SECTION